11-29-00 A

UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1 53(b))

Attorney Docket No.	207562
First Inventor	FELDBAU, Ofra
Title	Apparatus and Method for Authenticating the Dispatch and Contents of Documents
Express Mail Label No.	EL190831418US

JC858 U.S. PTO 09/724459 11/28/00

JC867 U.S. PTO 11/28/00

APPLICATION ELEMENTS

1. ☒ Utility Patent Application Transmittal Form
2. ☒ Applicant claims small entity status. See 37 CFR 1.27.
3. ☒ Specification (including claims and abstract) [Total Pages 50]
4. ☐ Drawings [Total Sheets 7]
5. ☒ Combined Declaration and Power of Attorney [Total Pages 3]
   a. ☐ Newly executed
   b. ☒ Copy from prior application [Note Box 6 below]
      i. ☐ Deletion of Inventor(s) Signed statement attached deleting inventor(s) named in the prior application
6. ☒ Incorporation by Reference: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 5b is considered as part of the disclosure of the accompanying application and is hereby incorporated by reference
7. ☐ Application Data Sheet. See 37 CFR 1.76
8. ☐ CD-ROM or CD-R in duplicate, large table or Computer Program (Appendix)
9. Nucleotide and/or Amino Acid Sequence Submission
   a. ☐ Computer Readable Form (CRF)
   b Specification Sequence Listing on:
      i. ☐ CD-ROM or CD-R (2 copies); or
      ii. ☐ Paper Copy
   c. ☐ Statement verifying identity of above copies

ADDRESS TO: Assistant Commissioner for Patents
Box Patent Application
Washington, DC 20231

ACCOMPANYING APPLICATION PARTS

10. ☐ Applicant requests early publication. (include publication fee under 37 CFR 1.18(d))
11. ☐ Assignment Papers (cover sheet and document(s))
12. ☐ 37 CFR 3.73(b) Statement (when there is an Assignee)
13. ☐ Power of Attorney
14. ☐ English Translation Document (if applicable)
15. ☐ Information Disclosure Statement (IDS)
    ☐ Form PTO-1449
    ☐ Copies of Listed Documents
16. ☒ Preliminary Amendment
17. ☒ Return Receipt Postcard (Should be specifically itemized)
18 ☐ Certified Copy of Priority Document(s)
19. ☐ Request & Certification Under 35 USC 122(b)(2)(B)(i) (Form PTO/SB/35 or its equivalent attached)
20. ☐ Other:

21. If a CONTINUING APPLICATION, check appropriate box and supply the requisite information in (a) and (b) below:

(a) ☒ Continuation ☐ Divisional ☐ Continuation-in-part of prior application no. 08/981,461. Prior application information: Examiner P. Callahan; Group Art Unit: 2767

(b) Preliminary Amendment: Benefit of earlier filing date - 35 USC 120. The Commissioner is requested to amend the specification by inserting the following sentence before the first line:
"This is a ☒ continuation ☐ divisional ☐ continuation-in-part (CIP) of ☒ Application No. 08/981,461, filed on December 23, 1997, which is incorporated by reference, which was based on International Application No. PCT/IB/00859, filed on August 27, 1996, which designates the U.S., and which is incorporated by reference."

UTILITY PATENT APPLICATION TRANSMITTAL	Attorney Docket No. 207562

APPLICATION FEES

BASIC FEE				$710.00
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total Claims	10 - 20=	0	x $18.00	$ 0
Independent Claims	8 - 3=	5	x $80.00	$ 400.00
☐ Multiple Dependent Claim if applicable			+$270.00	$
			Total of above calculations =	$ 400.00
			Reduction by 50% for filing by small entity =	$(555)
☐ Assignment fee if applicable			+ $40.00	$
☐ Early publication fee if applicable			+ $300.00	$
			TOTAL =	$555.00

22. ☐ Please charge my Deposit Account No. 12-1216 in the amount of $.

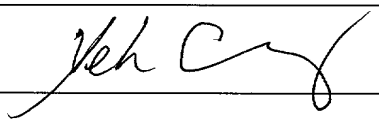
23. ☒ A check in the amount of $555.00 is enclosed.

24. The Commissioner is hereby authorized to credit overpayments or charge any additional fees of the following types to Deposit Account No. 12-1216:
    a. ☒ Fees required under 37 CFR 1.16.
    b. ☒ Fees required under 37 CFR 1.17.

25. ☐ The Commissioner is hereby generally authorized under 37 CFR 1.136(a)(3) to treat any future reply in this or any related application filed pursuant to 37 CFR 1.53 requiring an extension of time as incorporating a request therefor, and the Commissioner is hereby specifically authorized to charge Deposit Account No. 12-1216 for any fee that may be due in connection with such a request for an extension of time.

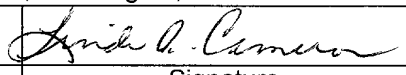
26. CORRESPONDENCE ADDRESS

☐Customer Number. 23460	☒Y. Kurt Chang, Reg. No 41,397
 **23460** PATENT TRADEMARK OFFICE	Leydig, Voit & Mayer, Ltd Two Prudential Plaza, Suite 4900 180 North Stetson Chicago, Illinois 60601-6780 (312) 616-5600 (telephone) (312) 616-5700 (facsimile)

Name	Y. Kurt Chang, Registration No. 41,397
Signature	
Date	November 28, 2000

Certificate of Mailing Under 37 CFR 1.10

I hereby certify that this Utility Patent Application Transmittal and all accompanying documents are being deposited with the United States Postal Service "Express Mail Post Office To Addressee" Service under 37 CFR 1.10 on the date indicated below and is addressed to: Assistant Commissioner of Patents, Box Patent Application, Washington, D.C. 20231.

LINDA A. CAMERON		November 28, 2000
Name of Person Signing	Signature	Date

PATENT
Attorney Docket No. 75483

Applicant or Patentee: Feldbau et al.
Serial or Patent No.
Filed or Issued: December 23, 1997
For: APPARATUS AND METHOD FOR AUTHENTICATING THE DISPATCH AND CONTENTS OF DOCUMENTS

VERIFIED STATEMENT (DECLARATION)
CLAIMING SMALL ENTITY STATUS
37 C.F.R. §§ 1.9(f) & 1.27(b) - INDEPENDENT INVENTOR

As a below-named inventor, I hereby declare that I qualify as an independent inventor as defined in 37 C.F.R. § 1.9(c), for purposes of paying reduced fees under Sections 41(a) and (b) of Title 35, United States Code, to the Patent and Trademark Office with regard to the invention entitled:

APPARATUS AND METHOD FOR AUTHENTICATING THE DISPATCH AND CONTENTS OF DOCUMENTS

described in:

☒ The specification filed herewith.
☐ Application Serial No. , filed .
☐ Patent No. , issued .

Others Having Rights In The Invention

I have not assigned, granted, conveyed, or licensed, and I am not under any obligation under contract or law to assign, grant, convey, or license, any rights in the invention to any person who could not be classified as an independent inventor under 37 C.F.R. § 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 C.F.R. § 1.9(d) or a nonprofit organization under 37 C.F.R. § 1.9(e).

Each person, concern, or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

☒ no such person, concern, or organization.
☐ persons, concerns, or organizations listed below. (NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to his/her/its status as a small entity.)

Name:
Address:

☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 C.F.R. § 1.28(b)).

I hereby declare that all statements made herein of my own knowledge are true, that all statements made on information and belief are believed to be true, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

Name of Inventor: **Ofra Feldbau**

Ofra Feldbau — Signature of Inventor

11/14/97 — Date

Name of Inventor: **Michael Feldbau**

Michael Feldbau — Signature of Inventor

11/14/97 — Date

PATENT
Attorney Docket No. 207562

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:
Feldbau et al.

Application No.

Filed: November 28, 2000

Group Art Unit: Not Assigned

Examiner: Not Assigned

For: APPARATUS AND METHOD FOR AUTHENTICATING THE DISPATCH AND CONTENTS OF DOCUMENTS

PRELIMINARY AMENDMENT

Commissioner of Patents and Trademarks
Washington, D.C. 20231

Dear Sir:

Prior to the examination of the present patent application, please enter the following amendments and consider the following remarks.

IN THE CLAIMS:

Please delete claims 1-63 and substitute therefor new claims **64-73** as follows:

--**64**. Apparatus for authenticating that certain information has been transmitted from a sender via a dispatcher to a recipient, the apparatus comprising:

means for providing a set A comprising a plurality of information elements a1,...,an, where said information element a1 is originated from the sender and comprising the contents of the information being electronically transmitted to said recipient, and said one or more information elements a2,...,an comprising dispatch-related information and comprise at least the following elements:

a2 - a time indication associated with said dispatch; and

a3 - information describing the destination of said dispatch,

and wherein at least said information element a2 is provided in a manner that is resistant to or indicative of tampering by either of said sender and said recipient; and

an authenticator functioning as a non-interested third party with respect to the sender and the receiver and having

(1) means for associating said dispatch-related information with said element a1 by generating authentication-information comprising a representation of at least said elements a1, a2 and a3, said representation comprising a set of one or more elements, each comprising a representation of one or more elements of said set A; and

(2) means for securing at least part of said authentication-information against tampering of said sender and recipient.

65. A method for authenticating that certain information has been transmitted from a sender via a dispatcher to a recipient, comprising the steps of:

providing a set A comprising a plurality of information elements a1,...,an, where said information element a1 is originated from the sender and comprising the contents of the information being electronically transmitted to said recipient, and said one or more information elements a2,...,an comprising dispatch-related information and comprise at least the following elements:

a2 - a time indication associated with said dispatch; and

a3 - information describing the destination of said dispatch,

and wherein at least said information element a2 is provided in a manner that is resistant to or indicative of tampering by either of said sender and said recipient;

associating, by an authenticator functioning as a non-interested third party with respect to the sender and the recipient, said dispatch-related information with said element a1 by generating authentication-information comprising a representation of at least said elements a1, a2 and a3, said representation comprising a set of one or more elements, each comprising a representation of one or more elements of said set A; and

securing, by said authenticator, at least part of said authentication-information against tampering of said sender and recipient.

66. A method of authenticating a dispatch and contents of the dispatch transmitted from a sender to a recipient, comprising the steps of:

receiving content data representative of the contents of the dispatch originated from the sender and being electrically transmitted to said recipient, and a destination of the dispatch;

providing an indicia relating to a time of transmission of the dispatch, said time related indicia being provided in a manner resistant to or indicative of tampering by either of the sender and the recipient;

associating, by an authenticator functioning as a non-interested third party with respect to the sender and the recipient, the content data with dispatch record data which includes at least said time related indicia and an indicia relating to the destination of the dispatch, to generate authentication data which authenticate the dispatch and the contents of the dispatch; and

securing, by said authenticator, at least part of the authentication data against tampering of the sender and the recipient.

67. An authenticator for authenticating a dispatch and contents of the dispatch transmitted by or for a sender from a transmitting system to a receiving system for a recipient via an electronic communication network, comprising:

an input unit coupled to the communication network or to the transmitting system for receiving content data representative of the contents of the dispatch being electronically transmitted to said receiving system, and a destination of the dispatch;

means for providing an indicia relating to a time of transmission of the dispatch, said time related indicia being provided in a manner resistant to or indicative of tampering by either of the sender and the recipient;

a processor for associating the content data with dispatching record data which includes at least said time related indicia and an indicia relating to the destination of the dispatcher and the contents of the dispatch; and

means for securing at least part of the authentication data against tampering of the sender and the recipient, the authenticator functioning as a non-interested third party with respect to the sender and the recipient.

68. An information dispatch system in an electronic communication network comprising;

a source transmitting system coupled to the electronic communicating network for sending a dispatch from a sender to a recipient;

a destination receiving system coupled to the electronic communication network for receiving the dispatch for the recipient; and

an authenticator functioning as a non-interested third party with respect to the sender and the recipient for authenticating the dispatch and contents of the dispatch transmitted from the source transmitting system to the destination receiving system, including:

(1) an input unit coupled to the communication network or to the source transmitting system for receiving content data representative of the contents of the dispatch being electronically transmitted to said destination receiving system, and a destination of the dispatch;

(2) means for providing an indicia relating to a time of transmission of the dispatch, said time related indicia being provided in a manner resistant to or indicative of tampering by either of the sender and the recipient;

(3) a processor for associating the content data with dispatch record data which includes at least said time related indicia and an indicia relating to the destination of the dispatch, to generate authentication data which authenticate the dispatch and the contents of the dispatch; and

(4) means for securing at least part of the authentication data against tampering of the sender and the recipient.

69. A method of authenticating a dispatch and contents of the dispatch from a sender to a recipient, comprising the steps of:

electronically receiving content data representative of the contents of the dispatch originated from the sender, and a destination of the dispatch;

generating a paper document printout of said electronic content data to be dispatched to said recipient via a selected manual delivery service;

providing an indicia relating to a time of the dispatch, said time related indicia being provided in a manner resistant to or indicative of tampering by either of the sender and the recipient;

associating, by an authenticator functioning as a non-interested third party with respect to the sender and the recipient, the content data with dispatch record data which includes at least said time related indicia and an indicia relating to the destination of the dispatch, to generate authentication data which authenticate the dispatch and the contents of the dispatch; and

securing, by said authenticator, at least part of the authentication data against tampering of the sender and the recipient.

70. A certificate for attesting a dispatch and contents of the dispatch, comprising a representation of the following authentication data:

content data representative of the contents of a dispatch being electronically transmitted by a sender to a recipient; and

dispatch record data which includes at least an indicia relating to the destination of the dispatch, said time related indicia being provided in a manner resistant to or indicative of tampering by either of the sender and the recipient, and at least part of said authentication data being secured against tampering of the sender and the recipient, wherein the

authentication data are generated and secured by an authenticator functioning as a non-interested third party with respect to the sender and the recipient.

71. A method for verifying the authenticity of either of the contents, the time and the destination relating to a dispatch from a sender to a recipient, comprising the steps of:

providing a representation of either of said information elements;

verifying said representation for match with a representation of at least part of authentication data, said authentication data generated by an authenticator functioning as a non-interested third party with respect to the sender and the recipient and comprising a representation of the following information element: content data representative of the contents of the dispatch being electronically transmitted by the sender, and dispatch record data which includes at least an indicia relating to a time of the dispatch and an indicia relating to the destination of the dispatch, said time related indicia being provided in a manner resistant to or indicative of tampering by either of the sender and the recipient, and said authentication data being secured against tampering of the sender and the recipient.

72. A method according to claim 72 wherein the step of verifying includes verifying according to a verifiable digital signature verification procedure or according to a digital time stamping service verification procedure or a combination of both.

73. A certificate according to claim70, wherein said authentication data is secured according to a digital signature or time stamping service scheme or a combination of both.--

REMARKS

The present application is a continuation of U.S. Application Serial No. 08/981,461, which was a national phase application of International Application No. PCT/IB96/00859. In the parent '461 application, a Final Action was issued on April 18, 2000. In response, applicants submitted a Request For Reconsideration And Amendment After Final ("the Request") on August 2, 2000. The Request was not entered. Nevertheless, after an Examiner Interview, applicants submitted a Supplemental Amendment After Final to implement certain

claim amendments suggested by the Examiner and agreed upon during the Examiner Interview, and the parent application was allowed.

By this Preliminary Amendment, the present continuation application includes claims 64-73. The correspondence between claims 64-72 and those of the parent application at the time the Request was filed is provided below:

Current Claim No.	Claim No. in Parent Application
64	64
65	94
66	125
67	137
68	149
69	158
70	159
71	160
72	161

In view of the following remarks, applicants respectfully submit that the claims should be allowable over the cited references relied upon in the Final Action for the parent application.

Turning to the rejections in the Final Action for the parent application, claims 64-66, 69, 71-79, 92-96, 98, 100, 101, 103-111, 123-127, 131, 132, 134, 137-140, 144, 145, 149-151, 153, 154, and 160 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Bouricius et al. (U.S. Patent 4,326,098) and an Official Notice that will be discussed in detail below. Claims 68, 80, 97, 111, 133, 147, 155, 158 and 161 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the Bouricius et al. reference and various Official Notices. Claim 159 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Schneier in view of further Official Notices.

To put the discussion in perspective, a brief recount of the prosecution of the parent application up to the Final Action is believed to be useful. In the first Office Action for the

parent application, independent claims 64, 94, 125, 137, 149, and 160 as well as selected dependent claims were rejected under 102(b,e) as being anticipated by Bouricius et al. Claim 159 was rejected under 35 U.S.C. § 102(b) as being anticipated by Schneier. Independent claims 158 and selected dependent claims were rejected under 35 U.S.C. § 103(a) as being unpatentable over Bouricius et al. in combination with Official Notices. With respect to claim 137 that was directed to an "authenticator", the first Office Action rejected the claim by asserting: "The applicants' claimed authenticator performs the Applicant's claimed method for authenticating." In the responsive Amendment, claim amendments were made such that all the independent claims require an authenticator that functions as a non-interested third party with respect to the sender and the recipient and generates and secures the dispatch authentication information. The second Office Action for the parent application, which was made final, repeated the same grounds of rejection given in the first Office Action, but added an Official Notice regarding the authenticator, and converted the original Section 102 rejections into Section 103 rejections.

Applicants submit that the Final Action for the parent application did not fully develop the grounds of the rejections. As described above, the first Office Action did not give due weight to the "authenticator," and applicants responded by adding this limitation to each of the independent claims to emphasize its importance. The Final Action, however, relied on an Official Notice to find the authenticator. Specifically, the Office Action asserted:

> Although Bouricius does not specifically teach an authenticator functioning as a non-interested third party with respect to the sender and the recipient, such an authenticator acting in such a manner is a feature that is old and well known in the art. Therefore it would have been obvious to one of ordinary in the art at the time the invention was made to have incorporated this feature into the method of Bouricius et al.

It is applicants' position that it would not have been obvious to combine any "such an authenticator" with the system of Bouricius et al. to reach the claimed invention. First of all, applicants respectfully traverse the assertion in the Final Action that "such an authenticator acting in such a manner is a feature that is old and well known in the art." Second, applicants

submit that it would not have been obvious to combine "such an authenticator" with the system of Bouricius et al. to somehow reach the claimed invention. This is because the system of Bouricius et al. and the present invention are based on two entirely different conceptual models. The system of Bouricius et al. is based on a model in which the sender and recipient of a dispatched document exchange signed copies of the document as proof of the dispatch. Thus, both the sender and recipient in the system of Bouricius et al. are responsible for generating, exchanging, and storing the proof of a dispatched document. The system of Bouricius et al. has a vault for assisting the sender and recipient of the dispatch to accomplish authenticated correspondence with each other. Although the vault is a non-interested third party in that process, it does not generate or secure any dispatch evidence. Rather, it serves merely as a secure and reliable communication channel between the correspondents. In this regard, by relying on the Official Notice regarding the "authenticator" limitations, the Office Action clearly recognized that the vault of Bouricius et al. is not the authenticator of the claimed invention.

In sharp contrast to the Bouricius et al. approach, in the claimed invention, neither the sender nor the recipient is concerned with generating or storing authentication information for the dispatch. Rather, it is the authenticator operating as a non-interested third party that generates the authentication information and secures it from tampering by the sender and/or the recipient. It is critical to note that since the sender and recipient in the system of Bouricius et al. are themselves responsible for generating and storing the proof of dispatch, that system does not have any need or any room for an authenticator of the claimed invention. This is because the signing of the dispatched document by the sender and recipient and exchanging the signed document is already sufficient for certifying the contents and dispatch of the document. Thus, it would not have been obvious to try to combine such an authenticator with the system of Bouricius et al. to somehow reach the claimed invention.

Accordingly, independent claims 64-69 and 71 (correspond to claims 64, 94, 125, 137, 149, 158, and 160 of the parent application, respectively), which all include the

"authenticator" limitation, should be allowable even if it is assumed that the Official Notice regarding the authenticator could be adequately supported. Claim 72 depends from claim 71 and should therefore also be allowable.

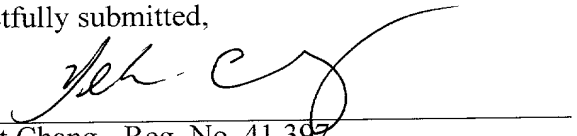
Independent claim 70 corresponds to claim 159 of the parent application, which was rejected in the Final Action for the parent application over Schneier in view of the Official Notice about the authenticator. According to the Final Action, Schneier explains a public certificate. As discussed above, the context and manner in which the authenticator operates is important to the consideration of patentability. The certificate issuing operation of Schneier is, however, not related to authenticating a dispatch and its contents from a sender to a recipient, and the certificate authority of Schneier is not the authenticator of the claimed invention. Thus, it would not have been obvious to combine the system of Schneier with authenticator to reach to claimed invention. Accordingly, claim 70 should be allowable. Claim 73 depends from claim 70 and thus should also be allowable.

Conclusion

In view of the foregoing, applicants respectfully submit that the present application is in good and proper form for allowance, and the Examiner is respectfully requested to pass this application to issue.

If, in the opinion of the Examiner, a telephone conference would expedite the prosecution of the subject application, the Examiner is invited to call the undersigned attorney.

Respectfully submitted,



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Date: November 28, 2000

APPARATUS AND METHOD FOR AUTHENTICATING THE DISPATCH AND CONTENTS OF DOCUMENTS

FIELD OF THE INVENTION

The present invention relates to a method and apparatus for authenticating the dispatch and the contents of dispatched information in general.

BACKGROUND OF THE INVENTION

Post, courier, forwarding and other mail services, which enable people to exchange documents and data, have been widely used both in the past and at the present time. With the evolution of modern technology, the use of electronic dispatch devices and systems, such as modems, facsimile machines, electronic mail (E-Mail) and EDI systems, computers, communication networks, and so forth, to exchange data and documents is rapidly evolving.

A substantial quantity of the information exchanged, such as contracts, purchase orders, invoices, monetary orders, notices, and even warning and notification messages, are of utmost importance. Sometimes, when a dispute arises between the sending and receiving party of the ex-

changed information, the receiving party may raise the claim that he never received the information, that the received information was different from what the sender claims to have sent, or the receiving party may even attempt to forge the received information.

The need, therefore, arises for the sender to prove that specific information has been sent at a specific time to that specific receiving party.

Various solutions to various related problems have been proposed in the literature. For example, the transmission operation itself may be authenticated, as shown in US Patent 5,339,361 (Schwalm et al.), which describes a communication system providing a verification system to identify both the sender and recipient of electronic information as well as an automatic time stamp for delivery of electronic information. This patent, however, does not verify the dispatched information.

Document authentication methods, for example by notarization, have long been in use. A method for notarization of electronic data is provided by EP-A-516 898 (PITNEY BOWES INC.) or its patent family member US Patent 5,022,080 (Durst et al.) which authenticates that source data has not been altered subsequent to a specific date and time. The method disclosed includes mathematically generating a second unit of data from the first unit of data, as by CRC generation, parity check or checksum. The second unit of data is then encrypted together with a time/date indication, and optionally with other information to form an authentication string. Validation that the first unit of data has not been changed is provided by comparing the original data's authentication string with the authentication string generated from the data and time in question. A method is even suggested for having the reci-

pient verify the authenticity of the sender, the time of transmission and the data.

Other patents which discuss document authentication are U.S. 5,136,646 and 5,136,647 both to Haber et al. According to these patents, a unique digital representation of the document (which is obtained by means of a one-way hash function) is transmitted to an outside agency, where the current time is added to form a receipt. According to patent 5,136,647, the receipt is certified using a cryptographic digital signature procedure, and is optionally linked to other contemporary such receipts thereby fixing the document's position in the continuum of time. According to patent 5,136,646, the receipt is certified by concatenating and hashing the receipt with the current record catenate certificate which itself is a number obtained by sequential hashing of each prior receipt with the extent catenate certificate.

Various cryptographic schemes are known in the prior art for encrypting and for authenticating digital data and/or its author. For example Symmetric algorithms such as DES [1.01] and IDEA [1.02], one-way hash functions [1.03] such as MD5 [1.04], Public-Key (asymmetric) algorithms [1.05] such as RSA [1.06], and verifiable digital signatures generation algorithms [1.12] such as DSA [1.07] or RSA, as well as combinations thereof such as PGP [1.08] and MACs [1.13], are currently widely used for security and for authentication purposes [1.09]. An excellent publication relating to encryption, authentication, public-key cryptography and to cryptography and data security in general, as well as applications thereof and additional references to multiple sources can be found in [1]. Further prior art, in particular referring to integrity of stored data, can be found in D.W. Davies & W.L. Price "Security for computer networks", 1989, John Wiley & Sons, Chichester (UK).

Proof of delivery of non-electronic documents is provided, for example, by Registered Mail and courier services. It is commonly used to authenticate the delivery of materials at a certain time to a certain party, and serves as admissible proof of delivery in a court of law. However, no proof is provided as to the information contents of the specific dispatch.

E-mail and other electronic messages forwarding services are commonly used today. The sender sends a message to the dispatching service which, in turn, forwards the message to the destination and provides the sender with a delivery report which typically includes the date and time of the dispatch, the recipient's address, the transmission completion status, and sometimes even the transmitted data, the number of pages delivered, the recipient's identification information, and so on. The provided delivery report mainly serves for accounting purposes and for notifying the sender of the dispatch and/or its contents. Moreover, frequently no record of the specific dispatched data is maintained with the service after the delivery is completed or provided to the sender.

SUMMARY OF THE PRESENT INVENTION

The literature does not provide a comprehensive solution that directly addresses the problem in question: what information has been sent to whom and when. Accordingly, there is a need for a method and system to provide the sender with a convenient means for authenticating both the dispatch and the contents of documents, electronic information and other information during the normal flow of daily activities.

It is therefore an object of the present invention to improve the capacity of conventional systems and methods for dispatching documents and transmitting information to

provide the sender with evidence he can use to prove both the dispatch and its contents.

The present invention discloses an apparatus according to claim 1 for authenticating that certain information has been sent by a sender via a dispatcher to a recipient, the apparatus comprising:

means for providing a set A comprising a plurality of information elements a1,...,an, said information element a1 comprising the contents of said dispatched information, and said one or more information elements a2,...,an containing dispatch-related information and comprise at least the following elements:

a2 - a time indication associated with said dispatch; and

a3 - information describing the destination of said dispatch,

and wherein at least one of said information elements is provided in a manner that is resistant or indicative of tamper attempts by said sender;

means for associating said dispatch-related information with said element a1 by generating authentication--information, in particular comprising a representation of at least said elements a1, a2 and a3, said representation comprising a set of one or more elements, each comprising a representation of one or more elements of said set A; and

means for securing at least part of said authentication-information against undetected tamper attempts of at least said sender.

Thus, the present invention provides a sender with the capability to prove both the dispatch and the contents of the dispatched materials. The dispatched materials can be paper documents, electronic information or other information which can be dispatched electronically by transmission or non-electronically, such as by courier or registered mail service, to an address of a recipient.

According to the present invention, dispatch related information is associated with the contents of the dispatch, in a relatively secure, or reliable manner. This associated information can be provided for example to the sender, and may serve as evidence of both the dispatch and its contents, for example, in a court of law, and therefore it is collectively referred to herein as the "authentication-information" or "evidence".

Additionally, the present invention discloses a method according to claim 27, wherein in essence, a set A comprising a plurality of information elements a1,...,an is provided, said information element a1 comprising the contents of the dispatched information, and said one or more information elements a2,...,an containing dispatch-related information and comprise at least the following elements:

a2 - a time indication associated with said dispatch; and

a3 - information describing the destination of said dispatch,

and wherein at least one of said information elements is provided in a manner that is resistant or indicative of tamper attempts by said sender.

Said dispatch-related information is associated with said element a1 by generating authentication-information, in particular comprising a representation of at least said elements a1, a2 and a3, said representation comprising a set of one or more elements, each comprising a representation of one or more elements of said set A, and at least part of said authentication-information is secured against undetected tamper attempts of at least said sender.

It is appreciated that in accordance with the present invention, the representation can comprise any number of any combination in any form of: the elements themselves, identical or equivalent elements such as copies thereof or

information describing or identifying these elements, information expressive as a mathematical function of one or more of these elements and so forth. Each combination may be maintained jointly or separately as desired. The representation has a recursive characteristic, i.e., it can comprise a representation of one or more of the above.

The present invention encompasses all types of information being dispatched, such as that found on paper documents or within electronic documents and other electronic data, and all types of dispatch methods, such as transmission via facsimile machines, modems, computer networks, electronic mail systems and so forth, or manually such as via registered mail or courier services.

The term "the contents of the dispatch" herein refers to any information element having information content the substance of which is equivalent to that of the information being dispatched. This includes for example the information source, either in paper document or electronic form, the actual dispatched information, any copies thereof, any descriptive information or portion of the information contents identifying the dispatched information, and so forth regardless of the representation or form.

The present invention also encompasses all types of methods and apparatuses which provide and/or associate the dispatch information with the contents in a relatively secure or reliable manner. The terms "relatively secure" and "reliable" herein mean "reasonably tamper-proof" or "tamper-detectable", i.e., that it is assured that the authentic information elements are provided and associated in a reliable manner, for example by a non-interested third party or by a device or by a combination of both, and furthermore, that the associated authentication-information is secured against fraudulent actions such as disassociation, modification, replacement etc., attempted by an interested

party such as the sending or receiving party, at least to the extent that such actions are detectable.

The dispatch information can be any information describing at least the time and destination of the dispatch and preferably the dispatch completion status. Other information relating to the dispatch, such as the identity of the sender and/or the recipient, handshake information, the actual elapsed dispatch time, the number of pages dispatched and so forth, the identification of the authenticator, for example its name, logo, stamp, etc., can also be provided.

Finally, the authentication-information can be secured or stored in a secure location or device, in its entirety or in part, together or separately, as desired.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be understood and appreciated more fully from the following detailed description taken in conjunction with the drawings in which:

Fig. 1 is a schematic pictorial illustration of the authentication method of the present invention implemented in a manual manner;

Fig. 2 is a schematic illustration of an authenticator, constructed and operative in accordance with a preferred embodiment of the present invention;

Fig. 3 is a schematic illustration of an alternative authenticator, constructed and operative in accordance with another preferred embodiment of the present invention;

Fig. 4 is a schematic illustration of an alternative authenticator, constructed and operative in accordance with additional preferred embodiment of the present invention

Figs. 5 and 6 are schematic illustrations of verification mechanisms constructed and operative in accordance with the authenticator of Fig. 4;

Fig. 7 is a schematic illustration of an alternative authenticator, constructed and operative in accordance with yet another preferred embodiment of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Reference is now made to Fig. 1 which illustrates the method of the present invention as it can be implemented for paper documents being sent non-electronically. The method of Fig. 1 can be implemented for documents sent via any document dispatching service, such as a courier service or the registered mail service of the post office.

The sender 10 provides the documents 12 to be sent and a destination address 14 to a clerk 20 of the document dispatching service. The clerk 20 prepares a dispatch sheet 26, which typically has a unique dispatch identifier (not shown) and has room for dispatch information such as the date and time of dispatch or delivery 16, the destination address 14, an indication 18 of proof of delivery such as the recipient's identity and/or signature, and optionally, additional dispatch information such as the dispatcher's signature and the identity of the sender 10, etc.

The clerk 20 fills in the dispatch sheet 26 with the date/time 16 and the address 14, and then prepares a copy 24 of the documents 12 and a copy 34 of the dispatch sheet 26, typically by utilizing a copy machine 22 or an electronic scanner. The clerk 20 then places the original

documents 12 into an envelope 28 carrying the address 14, and sends the envelope 28 to its destination 30. In one embodiment of the present invention the dispatching service utilizes a cash-register like device to fill in the dispatch sheet 26. This provides for reliable time stamping and automated dispatch record keeping. Furthermore, the electronic dispatch information produced by such device can be associated using a special mathematical method as discussed in greater detail hereinbelow.

The clerk 20 associates the copy 24 of the documents 12 with the copy 34 of the dispatch sheet 26 by any method, a few examples of which follow:

a) by inserting the documents copy 24 and the dispatch sheet copy 34 into an envelope 32;

b) by inserting the copy 24 of the documents into an envelope 32 and marking the dispatch identifier on the outside of the envelope 32;

c) by printing the dispatch identifier on the documents copy 24; or

d) attaching the copies 24 and 34 and applying the stamp of the dispatch service in such a manner that part of the stamp is on the copy 24 of the documents and part of the stamp is on the copy 34 of the dispatch sheet 26.

Preferably, the clerk 20 secures the copies 24 and 34 in a manner that makes it difficult to modify or replace the information contained therein, for example by marking the pages of the copy 24 with the dispatching service's signature, stamp or seal, by spreading each page with invisible or other ink, by sealing the envelope 32 or by retaining them in the service's secure file 36 and so forth.

In one embodiment of the present invention, the associated copies 24 and 34 are provided to the sender at this stage (where the dispatch sheet 26 is retained with the service to ascertain delivery and to fill in the proof of delivery indication 18) or after the delivery is completed. In another embodiment, the dispatch service retains, in a secure location 36, one or both of the copies 24 and 34.

The clerk 20 can also identify the authenticating party, for example via his signature, or by having the dispatch sheet copy 34 printed on the stationary of the dispatching service, by stamping the documents and/or dispatch sheet copies with the service's stamp, logo or seal, etc.

When it is desired to authenticate the dispatch of the original documents (and possibly also their receipt at the destination 30), either the sender or the document dispatching service provides the associated authentication-information, for example the envelope 32, unopened, to the party which required the authentication. When the envelope 32 is opened, it has associated therewith copies of both the dispatched documents and the dispatch information. The envelope 32 therefore, provides a reliable proof that the original documents 12 were dispatched on the date and to the destination listed on or in envelope 32.

It will be appreciated that, since a non-interested third party who is neither the sender nor the receiver copied the original documents 12 being sent, it is unlikely that the copies stored in the envelope 32 are other than copies of the original documents 12.

Various modifications can be made to the embodiment provided hereinabove without departing from the scope and spirit of the present invention. For example, the document copy could be sent to the destination while the original

could be authenticated. The authentication-information could be provided by the service, directly to the court of law. The document copy could be produced by a scanner or a camera and stored in an electronic or other storage device such as a disk or on microfilm, while a copy thereof is provided to the sender. The original dispatch sheet could be first filled out and then provided to the sender instead of using a copy. Moreover, the original documents could be scanned by the sender in the service's premises into a secure disk and one printed copy thereof could be sent by the service to the destination while another copy could be authenticated and provided to the sender. Alternatively, the documents could be provided to the service via transmission (e.g., by facsimile machine) rather than manually. In the case of a courier, the courier could produce the copy himself using a photocopier at the sender's premises, and so forth.

Reference is now made to Fig. 2 which illustrates an authenticator 70, constructed and operative in accordance with a preferred embodiment of the present invention, which can be part of a system for transmitting information, whether by facsimile machine, modem, computer, network or E-Mail stations, and any combinations thereof, or by other electronic means.

Fig. 2 illustrates a data communication system comprising a sending transceiver 42, a communication line 45, coupled to the sending transceiver 42, a communication network 44 and a receiving transceiver 46. Authenticator 70 of the present invention communicates at least with the sending transceiver 42, and can form part of the sending transceiver 42 or can be separated therefrom.

The sender provides original materials 40 for transmission, which can be paper documents or electronic information such as computer disk, memory and other electronic

information including audio/video, text and graphics files or pictures. The sender also provides the destination address 52 which represents the address of the receiving transceiver 46 on communication network 44. The address 52 may for example be a dial number, a network user code and so forth. The sending transceiver 42 needs to transmit the information contents of the materials 40 to the receiving transceiver 46. To provide authentication, the transmission in Fig. 2 is performed through the authenticator 70 in a "store & forward" manner.

The authenticator 70 comprises input means 72 for receiving the transmitted information 60 and the destination address 62 from the communication line 45. The input means 72 may for example comprise a line interface, a Dual-Tone Multi Frequency (DTMF) decoder for receiving a destination address 62 such as a dial number, and a transceiver similar to that of the sending transceiver 42 which can receive the information 60.

The authenticator 70 also comprises an optional storage unit 54 such as a tape, disk or memory device and so forth for storing the information 60 and related dispatch information, an internal clock 50 for generating a time indication 66 of the transmission, a transceiver 76 for transmitting the information 60 to address 62 (the transceiver 76 can be used by the input unit 72 as well, for example by using a relay mechanism), a controller 56, a user interface 48, and an output unit 58 for providing the authentication-information, for example to the sender.

The information 60 is then transmitted over the communication network 44 to the receiving transceiver 46 by the transceiver 76 using the address 62.

The internal clock 50 provides an indication 66 of the current time, and is utilized to provide a time indica-

tion for the transmission. Internal clock 50 is securable (to ensure the veracity of the produced time indication 66), and preferably provides time indications according to a non-changing time standard, such as Greenwich-Mean-Time (G.M.T.) or UTC. Alternatively, the time indication 66 can be externally obtained, for example from a communication network server, as long as the source is secured from being set or modified by an interested party such as the sender. The security of the time indication can be provided in a number of ways, such as by factory pre-setting the clock 50 and disabling or password securing the Set Date/Time function of the internal clock 50. Alternatively, the clock 50 can maintain a "true offset" with the true preset date/time, that reflects the offset of the user set date/-time from the genuine preset one.

The transmission completion indication 64 provides information regarding the success of the transmission. It is typically obtained from the communication protocol used by the transceiver 76. It may be for example in the form of an electronic signal provided by the transceiver 76 which is used to determine the validity of the rest of authentication-information, or in a form similar to that provided in transmission reports such as "TRANSMISSION OK" or "ERROR". In one embodiment of the present invention, the fact that the rest of authentication-information elements are provided, indicates that an affirmative completion indication has been provided.

The storage unit 54 is used for storing the information 60 and/or the dispatch information, including the address 62, the time indication 66, and optionally the transmission completion indication 64. Typically, the storage unit 54 is relatively secure, such that the authentication-information contained therein is assumed unchangeable. For example it may be a Write-Once-Read-Many (WORM) device such as an optical disk or a Programmable

Read-Only Memory (PROM) device, it may be enclosed within a securable device, or it may be provided with read-only access privilege. Alternatively, the authentication-information is stored in a secure manner, for example using a compression, private or public key encryption or scrambling technique, a password, or a combination thereof, such as those employed by the widely used RSA encryption method, and by the PKZIP(tm) program from PKWARE Inc., Glendale Wisconsin, U.S.A., and where the "securing" procedure, key or password are unknown to any interested party.

The controller 56 associates the information 60 and the dispatch information, by storing them in storage unit 54 and by associating link information with the stored authentication-information, for example in the form of a unique dispatch identifier such as a sequential dispatch number.

To provide the authentication-information for the transmission, the dispatch identifier is provided to the controller 56 through the user interface 48. The controller 56, in turn, retrieves the various stored authentication-information elements from storage unit 54. If the stored information is also secured (i.e., by compression, password, etc.), the controller 56 "unsecures" them, and then provides them to the output unit 58.

The output unit 58 provides the authentication-information to an output device (not shown). The authenticator 70 may include an output device or may communicate with some external unit. The output device can be, for example, a printing unit, a display unit, a storage unit such as a computer disk, the printing apparatus of the sending transceiver 42 and so forth.

The information 60 and the dispatch information, can be associated with each other in any suitable manner. For

example, if the materials 40 provided for transmission are paper documents, one embodiment of the authenticator 70 authenticates the original documents by printing the dispatch information on them. In another embodiment, they can be stored in storage unit 54 together (e.g., sequentially or combined into a single file), or separately using a link information element (e.g., using a dispatch identifier). If the output is a printout, output unit 58 typically formats the printout to indicate the dispatch information on at least one, and preferably on all, of the pages containing the printout. Alternatively, a link information element, such as a dispatch identifier, can be printed on each printed page of the information 60, and separately on a dispatch page containing the dispatch information. Another method includes printing both the information 60 and the dispatch information together on contiguous paper, optionally between starting and ending messages, and so forth. An alternative special mathematical association method is discussed hereinbelow.

Typically, the authenticator 70 is relatively secure, such that the various devices and the authentication-information elements enclosed therein can be assumed to be unchangeable. For example, the authenticator 70 can be enclosed within a password protected sealed electronic box which, if opened without authorization, may disable the normal operation of the authenticator 70, or may clearly indicate that it has been tampered with.

As mentioned hereinabove, the authenticator 70 can form part of the sending transceiver 42. Fig. 3 illustrates such an embodiment, which is similar to that of Fig. 2 and similar functional elements have similar reference numerals.

In Fig. 3, the input unit 72 of the sending transceiver 42 comprises means, for example a serial, parallel or

disk interface, for inputting the information 60 and the destination address 62 from any component of the sending transceiver 42, for example from its input devices. The sending transceiver 42 replaces the transceiver 76 of Fig. 2. The storage unit 54 however is optional, as the information 60 and the related dispatch information could be provided to the output unit 58 "on-the-fly" in a manner similar to that used by the "copy" function of document facsimile machines.

Generally, in various embodiments of the authenticator 70, the information 60 can be obtained from any source and by any means, including a computer, a disk drive, a scanner or any other component of the sending transceiver 42, a communication line, a communication network and any combinations thereof, and so forth.

It is appreciated that in accordance with the present invention, the various information elements can be provided, generated, associated or secured either by single, combined or separate means of the authenticator 70.

Furthermore, any information element having information content the substance of which is equivalent to that of the transmitted information can serve for authentication purposes, regardless of its form, representation, format or resolution, whether it is a paper document or electronic information, whether digital or analog, whether in form of dots and lines or alphanumeric, binary, hexadecimal and other characters, or whether it is encrypted, compressed or represented otherwise, and so forth. The element may contain additional information which does not change the substance and its content, such as a logo, a header message, etc. Furthermore, it may contain control, handshake and even noise data. Alternatively, an information descriptor such as a form number or name can be provided, and/or any

other information content such as the form's filled-in data, which identifies the dispatched information.

Optionally, additional dispatch information may be provided to, or generated by authenticator 70, such as the number of pages transmitted, page numbers, the sender's identification, the sending transceiver's 42 identification, the receiving transceiver's 46 identification, the transmission elapsed time, a transmission identifier, integrity information such as a cyclic redundancy code (CRC), a checksum or the length of the transmitted information, an authenticator identification indication such as a serial number, a verification from the communication network 44 that the transmission has actually taken place at the specified time from the sender to the recipient's address, a heading message, a trailing message and so forth.

Typically, when the authenticator 70 comprises a reasonably secure storage unit 54, the stored information is retained therein and copies thereof are provided to the output unit 58. Preferably, the provided output or any part thereof is reasonably secured, so as to prevent any fraudulent action. For example, if the output is a printout, it can be secured by spreading invisible or other ink on it, or by using special ink, special print fonts or special paper to print the authentication-information, or in any other suitable manner. Another method includes securing the dispatch information using, for example, an encryption technique, and printing the encrypted information on the printout. At a later stage the encrypted information can be decrypted to provide the true dispatch information, and so forth. Likewise, mathematical association method as discussed hereinbelow can also be used.

It will be appreciated that the following embodiments fall within the scope of the present invention:

The authenticator of the present invention can operate for information, such as a document produced by a word processor, transmitted through a computer. In this embodiment, the computer may include the secure time generator (which may for example be externally plugged into the parallel port). The authenticator obtains the dispatch information from the transceiver, and the document is provided from the hard disk or word processing program. The authenticator encrypts the document and the dispatch information together and stores them in a file. When authentication is required, the authenticator retrieves the stored file, decrypts it and provides the document and the dispatch information associated therewith to a printer.

Similarly, information transmitted in a computer network or electronic mail system can be authenticated, for example, by having a file server or mail manager (whose time generator is considered secure) store the transmitted information together with its associated dispatch information in a secure manner. One embodiment of secure storage is that which has read-only privileges. Alternatively, such read-only effect can also be obtained by having the authentication-information encrypted with the authenticator's private key: everybody can decrypt it using the authenticator'a public key, but no interested party can change it without such action being detectable.

The present invention can be operated in conjunction with a message transmission forwarding service such as that provided by Graphnet Inc. of Teaneck, New Jersey, USA. The service obtains the information and address from the sender, typically by an electronic transmission, occasionally converts it (for example from ASCII text or word processor format into a transmissible document format) and forwards it to the requested address. The forwarding service serves as the authenticator and may for example provide the dispatch information associated with the transmitted informa-

tion to the sender in a secure manner, such as in a sealed envelope or in encrypted form.

An efficient method for associating a plurality of information elements is by associating a digital representation thereof using a method referred to herein as "mathematical association". A digital representation of an information element can be considered as a number, for example as the element's standard binary, hexadecimal or other base representation. Using mathematical association, rather than maintaining the information elements (numbers) themselves, it is sufficient to maintain the results (also numbers) of one or more functions which are applied to one or more of these information elements. (These results are sometimes referred to as "message-digests", "hash-values" or "digital-signatures"). More formally, if A is a set of information elements, and F is the mathematical association function, then the set B of information elements is obtained as the result of applying the function F to the set A of information elements, i.e. B=F(A).

Preferably, the function F is selected such that a fraudulent attempt to change the elements of the set A, or an attempt to claim that a set A' which comprises different elements is the original set, can be readily detected by comparing the result B' obtained by applying the function F to the set A', to the original result B, i.e., by chekking if F(A')=F(A).

It would be advantageous to select the function according to a cryptographic schemes. Encryption and digital envelope functions can provide for secure data interchange. Digital signatures can provide for accurate and reliable verification of both the signature generator and the data. One-way hash functions provides for security, and can reduce the size of the generated signatures while still enable verification of the original data used to generate these

signatures. Utilizing combinations of cryptographic schemes can optimize particular implementations.

Various function classes of various degrees of complexity can be used for mathematical association purposes in accordance with various embodiments of the present invention. Furthermore, the function F and/or the result B can be kept secret and unknown in general, and to interested parties such as the sender or the recipient in particular. However, even if the function F and/or the result B are known, the task of finding a meaningful different set A′ such that B=F(A′) is mostly very difficult even for relatively simple functions, not to mention for more complex ones.

A special class of functions most suitable for the purposes of the present invention is the class of functions having the property that given the result B = F(A), it is exceptionally difficult to find a second set A′ such that applying the function F to the second set A′ will yield the same result B. The term "exceptionally difficult" refers herein to the fact that although many different such sets A′ may exist, it is so difficult to find even one of them (sometimes even to find the set A itself) that it is practically infeasible. In fact, the functions of this class "hide" the elements they are applied to, (and sometimes the elements even cannot be reconstructed) and therefore this class is referred to herein as "the Hiding Class".

There are many advantages to using mathematical association in general, and functions of the Hiding Class in particular:

(a) It is efficient, for example for saving storage space and transmission bandwidth, to maintain a function result, the size of which is normally very small as compa-

red to the original information elements themselves which can be arbitrarily large.

(b) It provides security, since the result is cryptic and there is no need to secure the information elements themselves. Furthermore, it is difficult, and sometimes infeasible to reconstruct the original elements.

(c) It provides a clear indication as to the authenticity of the elements of the set A used by the function to generate the result B. At any later time, the result B′ obtained by applying the function F to a purported set A′ can be compared to the original result B, and a match indicates beyond any reasonable doubt that set A′ is same as the original set A. Moreover, integrity information such as the length of the information elements of the set A can be added and used as part of the set A, or the results of a plurality of functions can be maintained such that to make the task of finding such a different set A′ infeasible.

(d) The result B′ provided for comparison must be equal to the original result B, since any change to A will yield a different result B′ with very high probability, and even if by chance a different set A′ is found for which F(A′)=B, the chance that it will be meaningful or will have the same length is practically zero.

(e) The function can be selected such that it is relatively easy and fast to compute the function result.

Few well known and widely used functions of the Hiding class are encryption functions (e.g., the RSA [1.06] or the DES [1.01] algorithms) and Cyclic-Redundancy-Check [3] (C.R.C.) functions (e.g., the C.R.C-32 function). While C.R.C functions are generally used in applications requiring verification as to the integrity of an arbitrari-

ly long block of data, encryption is used to maintain the original data elements, though in different, cryptic representation. Encryption functions convert the information elements into one or more cryptic data blocks using one key, while enabling their reconstruction by providing a matching (same or different) key. Other well known members of this class of functions in the prior art are compression functions (e.g., the Lempel-Ziv 1977 [5] and 1978 algorithms), one-way hash functions [1.03] (e.g., the MD4 [4], and MD5 [1.04] algorithms), and MACs [1.13].

Since for authentication purposes there is no need to maintain the original information elements, the use of encryption functions (which normally maintain the information - though in a cryptic representation) may be inefficient. One-way hash functions (and other functions of the Hiding Class), on the other hand, maintain a small sized result value, but the information elements from which the result has been produced are secured, i.e., cannot be reconstructed therefrom. It would be more advantageous, for example, to apply a one-way hash function to the union of all the information elements, i.e., to a bit-string, where the leftmost bit is the leftmost bit of the first element, and the rightmost bit is the rightmost bit of the last element. This produces a cryptic and secure result, as described hereinabove. Furthermore, one-way hash functions can be computed relatively quickly and easily.

Generally and more formally, the result B is a set of one or more information elements b1,...,bm, where each element bi (which itself can comprise one or more information elements) is the result of applying a (possibly different) function Fi to a subset Si of a set A which comprises one or more information elements a1,...,an, where the various subsets Si are not necessarily disjoint or different, each subset Si includes at least a portion of one or more (or even all) of the electronic information elements of the

set A, and where each function Fi can comprise one or more functions (i.e., Fi can be the composition of functions). Preferably, the functions Fi are members of the Hiding Class. The elements of such a subset Si are considered to be mathematically associated.

Assuming that the set A comprises five information elements a1,a2,a3,a4,a5, a few examples of mathematical association function Fi and their result set B follow: (the UNION function is denoted as U(x1,...,xk), which is an information element comprising a bit-string, where the leftmost bit is the leftmost bit of the element x1, and the rightmost bit is the rightmost bit of the element xk.)

(a) single element result set B

b1=F1(S1)=F1(a1,a4,a5) = a1/(a4+a5+1)
b1=F1(S1)=F1(a1,a3,a4) = ENCRYPT(U(a1,a3,a4))
b1=F1(S1)=F1(a1,a2,a3,a4,a5) =
MD5(U(a1,a2,a3,a4,a5)) * C.R.C(a3) mod 5933333
b1=F1(S1)=F1(a1,a2,a3,a4,a5) =
C.R.C(ENCRYPT(U(a1,a2)), COMPRESS(U(a2,a3,a4)), a1, a5)
b1=F1(S1)=F1(a1,a2,a3,a4,a5) =
U(a1,a2,a3,a4,a5) mod p (where p is a large Prime number)
b1=F1(S1)=F1(a1,a2,a3,a4,a5) =
ENCRYPT(MD5(U(a1,a2,a3,a4,a5)))

(b) multi-element result set B

B = [C.R.C(U(a1,a3)), a2/(a1+1), ENCRYPT(a5)]
b1=F1(S1)=F1(a1,a3) = C.R.C(a1,a3)
b2=F2(S2)=F2(a1,a2) = a2/(a1+1)
b3=F3(S3)=F3(a5) = ENCRYPT(a5)

The elements of two or more (not necessarily disjoint) subsets of set A can be associated with each other by associating the elements of the result set B which correspond to these subsets, either mathematically, or by non-mathematical methods, as described hereinabove. Furthermore, if there is a subset of elements of set A to

which no function has been applied, these elements may be associated with the elements of the result set B, again either mathematically or by non-mathematical methods.

Moreover, the elements of two or more subsets of the set A can be associated with each other by associating the elements of each of these subsets with a common subset comprising one or more elements of the set A, where this common subset uniquely relates to the specific dispatch. This type of association is referred to herein as "indirect association", and the elements of this common subset are referred to herein as "link elements". A link element can be for example a unique dispatch number, or the subset comprising the time indication and a machine serial number, etc.

For example, assuming that the element a2 of the above set A uniquely relates to the dispatch, the following function generates a multi-element result set B:

B = [b1,b2,b3] = [ENCRYPT(a1,a2), COMPRESS(a2,a3,a4), a2+a5]

where the subsets Si include the following elements: S1=[a1,a2], S2=[a2,a3,a4] and S3=[a2,a5]. The elements of each subset are mathematically associated. Since all of these subsets include the common link-element a2, all their elements (in this case all the elements of the set A) are associated with each other.

Reference is now made to Fig. 4 which is a block diagram that illustrates an authenticator 100, constructed and operative in accordance with a preferred embodiment of the present invention. The authenticator 100 comprises a secure time generator 104, a storage device 106 and a function executor 102 which has means for inputting the following information elements: the transmitted information, the destination address, a time indication generated

by the secure time generator 104, and a dispatch completion indication. Optionally, additional information elements can be provided as well.

The function executor 102 can be for example a Microchip Technology Inc.'s PIC16C5x series EPROM-based microcontroller, and the input means can be for example an I/O port, a serial, parallel or disk interface. The function executor 102 is capable of executing a function F on at least one, and preferably on the union of all of the input elements, and of generating a result information element which is provided to a storage device 106, and optionally to an output device 108, such as a printing device.

Preferably, the function F is a member of the Hiding Class, and is kept unknown at least to any interested party, by the function executor 102. This can be achieved for example by enabling the code protection feature of the PIC16C5x series microcontroller. Alternatively, a MAC [1.13] such as a one-way hash function MAC can be used where secret codes, keys and data relating to the function can be for example stored in a shielded memory device which is automatically erased if the authenticator 100 is tampered with. Also, preferably the storage device 106 is a WORM device, such as a PROM. Preferably, a different function is used for each device employing the function F. This can be achieved for example by using different keys or codes with each function.

In accordance with one embodiment of the present invention, the authenticator further comprises a verification mechanism for verifying the authenticity of a set of information elements purported to be identical to the original set of information elements. It is however appreciated that the verification mechanism can be separated therefrom.

Reference is now made to Fig. 5 which is a block diagram that illustrates a verification mechanism 120, constructed and operative in accordance with a preferred embodiment of the present invention, where at least part of the information elements were mathematically associated by the authenticator 100 of Fig. 4.

The verification mechanism 120 includes a function executor 122 for generating a new result information element according to the same function employed by the function executor 102 of Fig. 4. The function executor 122 has means for inputting information elements corresponding to the original information elements input to the function executor 102 of Fig. 4., and which are purported to be identical to those original elements.

The verification mechanism 120 also comprises a comparator 124, which has input means for inputting the newly generated result information element and the original result information element which may be obtained from the storage device 106 of Fig. 4, or manually, for example through a keyboard. The comparator 124 then compares the two provided result information elements to determine if they are the same, and the comparison result can be output for example to a display or printing unit. A match indicates that the purported information elements are authentic.

Reference is now made to Fig. 6 which is a block diagram that illustrates a verification mechanism 140, constructed and operative in accordance with a preferred embodiment of the present invention, where the information elements were associated non-mathematically, and are for example stored in storage unit 54 by the authenticator 70 of Fig. 2.

The verification mechanism 140 comprises a comparator 144, which has input means for inputting at least one of

the stored associated information elements from the storage unit 54 of Fig. 2. The comparator 124 also has input means for inputting the corresponding information elements purported to be identical to the stored elements. The comparator 124 then compares the corresponding information elements to determine if they are the same, and the comparison result can be output for example to a display or printing unit. A match of all the compared elements indicates that the purported information elements are authentic.

It is appreciated that various embodiments of the present invention can include a combination of the verification mechanisms described hereinabove.

Also, part of the securing methods which were described for Fig. 2 include for example encryption and compression - methods which formally relate to mathematical association functions such as ENCRYPT(a1,...,aj) and COMPRESS(a1,...,aj). Occasionally, there is a need for reconstructing some or all of the secured mathematically associated information elements, for example for providing them to an output unit or to the comparator of the verification mechanism. Since some compression and encryption functions (as some other functions) are reversible, they are typically used when reconstruction of the elements is needed. (A function G is considered reversible if there exists a function H such that H(G(x))=x, and the function H is called the inverse function of G).

As discussed hereinabove, a mathematical association function can generally comprise a single function, or the composition of two or more functions. For example, the function ENCRYPT(a1,...,aj) comprises a single function - ENCRYPT, which is reversible, and its inverse function is DECRYPT. Another function COMPRESS(ENCRYPT(a1),C.R.C(a2,...,aj)) is the composition of three functions - COMPRESS, ENCRYPT and C.R.C, where the first

two are reversible and their inverse function are DECOMPRESS (which yields the set comprising ENCRYPT(a1) and C.R.C(a2,...,aj)), and DECRYPT (which yields the element a1) respectively. The C.R.C function however, is not reversible.

Formally, if a function Fi comprises one or more functions, some of which are reversible, a set C comprising one or more information elements c1,...,ck can be generated, where this set C is expressive as a function I applied to the result information element bi of the function Fi, where this function I comprises the inverse function of one or more of these reversible functions.

While the authentication methods described hereinabove refer mostly to symmetric digital signatures, a preferred authentication method may be obtained using public--key digital signatures. A major advantage of public-key digital signatures over symmetric digital signatures is that they enable any third party (such as a judge), to verify the authenticity of both the data and the signer (where by using symmetric digital signatures, only a designated authenticator such as a secure device or a trusted third party, which have knowledge of the function, secret keys/codes etc., can perform the verification). The data is guaranteed not to be tampered with, and furthermore, once the data is signed, the signer is actually "committed" to it and cannot later repudiate his commitment to the digitally signed data, for only the signer which has sole knowledge of his private key could have created the signature, thus allowing such data to be legally binding.

Typically, public-key digital signatures generation and data authentication in performed in the following manner: a computation involving the signer's private key and the data, which can comprise various elements such as the dispatched message, the time indication, the destination

address, and so forth is performed; the output is the digital signature, and may be attached to the data or separated therefrom. In later attempt of verification of the data, some computation involving the purported data, the signature, and signer's public key is performed. If the results properly hold in simple mathematical relation, the data is verified as genuine; otherwise, it may be forged or may have been altered or otherwise tampered with.

Since the signing process using the whole (plain) data is generally time consuming and the signature consumes a considerable amount of storage space, typically a relatively unique representation (also called a "fingerprint" or the "message digest") of the data is first generated using a process in which the data is "condensed" or "hashed", for example by means of a one-way hash function into a relative small value, thereby fixing its contents, and the signing process is performed on the fingerprint, resulting in an equivalent effective authentication. Therefore, the term digital signature herein refers to the digital signature of either the plain data element(s) or of any representation (function) thereof.

As described hereinabove, the fingerprint of a series of data elements can be generated thereby fixing their contents and associating them with each other. Since public-key digital signatures belong to the "Hiding Class", and since they further own the property that they can be generated with one key (such as the private key), and provide for later non-repudiable verification using another matching key (such as the public key), the usage of such functions for the purposes of the present invention is therefore of great advantage.

Reference is now made to Fig. 7 which is a block diagram that illustrates an E-Mail system 700, and a message dispatch and authentication service 750, constructed and

operative in accordance with a preferred embodiment of the present invention. The sender 701 provides the E-Mail message 702 and the recipient's 799 E-Mail address 704 to the message dispatch and authentication service 750. Without limiting the generality, although reference is made to E-Mail dispatching services and systems in general, it is appreciated that implementations relating to the embodiments described herein can be easily extended, modified, ported or derived therefrom to other electronic data dispatch systems.

The dispatched message 702 may comprise any digital data such as text, pictorial, graphic, audio and video data, any number of files etc., in any form or representation e.g., compressed, encrypted, plaintext etc. Preferably, the message 702 includes the sender's 701 digital signature, which the sender can generate by means of his private key, in order to establish the sender's "commitment" to the message 702, and to provide for verification of the message and sender as the message originator, any third party using the sender's public key.

Digital signatures can be generated in system 700 for example by means of a verifiable public-key algorithm such as RSA or DSA. Fingerprints can be generated for example by means of a one-way hash function such as MD4 or MD5.

The service 750 forwards the message 701 to the recipient 799 using the address 704. The service 750, preferably after assuring that the message has been successfully delivered, adds (e.g., appends) a dispatch time indication 720 to the message 702 and the address 704, as well as information 708 indicating the success (or failure) of the message delivery. Obviously, additional dispatch information elements, such as a sequential dispatch number, the sender, recipient and the service identification information and so forth may be added as well.

The service 750 then associates the above data elements for example by generating their fingerprint, which is then signed using the service's private key 752, to produce the service's signature 742. Signing the fingerprint can reduce the resulting signature 742 computation time, transmission bandwidth and storage space. The service then provides back to the sender 701 a service's generated certificate 740 comprising the service's signature 742 and optionally various dispatch information elements from which it has been generated (there is no need to provide the message 702 and address 704 since they are already with the sender 701), thus the certificate 740 is typically tiny.

Thus, for example, using RSA to generate the signature, if M is the dispatched message 702, A is the address 704, T is the time indication 720, I is the delivery information 708, and Ka is the authentication service's RSA private key, then the following is a sample calculation of S - the signature 742:

$$S = RSA(MD5(U(T,I,M,A)), Ka)$$

The certificate 740, which comprises the service's digital signature for the dispatch transaction, constitutes an non-repudiable evidence witnessed by the service for the dispatch and its contents, since the dispatched message contents is securely associated with the dispatch information (by means of the service's generated signature and/or fingerprint), and since the signature, the message and the dispatch information can at any later time be authenticated and verified by any third party both for integrity and originality by means of the service's public key (and if the message has also been signed by the sender, it can further be verified in the same manner using the sender's public key).

Thus, for example if PBKa is the service's public key, then by providing the above signature S - the purported message M', time indication T', address A' and delivery information I', can be authenticated by verifying that the following relation holds:

$$RSA(S, PBKa) = MD5(U(T',I',M',A'))$$

To increase the credibility of the system, a record of the certificate 740 can be kept with the service, and furthermore, a copy of the certificate 740 can be provided for storage to one or more trustees, such as a designated authority, or law and/or public accounting firms. Alternatively, the certificate 740 may itself be signed by one or more trustees, using their private keys.

A related embodiment can utilize a Time Stamping Service (TSS) such as the Digital Notary System (DNS) provided by Surety Technologies Inc. [1.10], which has been proposed by Haber et al. in their U.S. patent documents [2]. The certificate 740 or any portion thereof (such as the signature 742) can be sent to the DNS to be time stamped. Alternatively, an embodiment of the present invention could internally implement the DNS scheme. The DNS generates a certificate authenticating the certificate 740. Utilizing such time stamping schemes is of great advantage, since the DNS generated certificates are virtually unforgeable, and there is no need to deposit copies of the certificates with trustees. Since in this case the DNS time stamps the certificate 740 anyway, the service 750 itself optionally need not add the time indication 720.

Thus, for example, if C is the certificate 740 (not including the time indication 720), which comprises A, I, N and S (as defined above), and T is the time indication added by the DNS, then DNSC - the DNS generated certificate may be calculated as follows:

DNSC = DNS (C, T)

As mentioned above, the message 702 is preferably digitally signed with the sender's 701 private key, to enable authentication of the sender's identity as the message originator using the sender's public key, to establish the sender's non-repudiable commitment to the message, and to verify the message integrity.

Nevertheless, any other method can be used for identification and/or authentication of the sender, though such methods can sometimes be more vulnerable or less effective. One embodiment for example could utilize an hardware component (preferably secured) with the sender's unique identification information "burned-into". In another embodiment the service 750 can utilize various log-in procedures to identify and authenticate the sender when he logs-in to obtain service. Sample authentication protocols and schemes are described in [1.09] and [1.11].

Likewise, the identity of the recipient's 799 of the message can be authenticated in similar manners. This is useful for example when both the sender and the recipient log-into the same dispatch service for E-Mail transactions. However, the message 702 is frequently delivered to another E-Mail server (acting as the recipient's agent, where the recipient later logs-in, identifies himself and downloads his messages) rather than to the recipient himself.

In such embodiments, it might be sufficient to obtain proof of delivery from the receiving server, for example in form of a server's digitally signed certificate, which may for example comprise the server's identification information, a dispatch identifier, the recipient's address and preferably the message and so forth (or a fingerprint thereof) - while assuming that the message will eventually reach the recipient. Alternatively, a later proof of the

final delivery may be obtained from that receiving server. Such delivery details as described above may be included in the delivery information 708.

In order to avoid potential disputes, as for example in case of contractual E-Mail correspondence, it may be useful to back up such correspondence by an agreement where the parties agree that delivery indication provided by the recipient's agent is to be considered an acceptable proof of delivery to the recipient. Alternatively, it may be agreed that multiple (two, three or more times of) certified dispatches of the message to be considered an acceptable proof of delivery and so forth.

In one preferred embodiment, the recipient (or its agent) may provide a counter-signature (using his private key) for the message, the sender's digital signature of the message, or the service's certificate or for any portions thereof. This may provide an ultimate evidence for the message dispatch, its contents, its time and its delivery to its destination. Thus if Ks, Kr, Ka are the private keys of the sender, the recipient (or his agent) and the authentication service 750 respectively, M is the dispatched message 702, T is the time indication 720, N is a sequential dispatch number, IDs and IDr are the identification information of the sender and recipient respectively, and A is the recipient's address 704, then the following sample calculations of S - the signature 742 can be performed:

1. S = RSA(Ka,MD5(U(N,A,T,M,IDs,IDr)))
2. S = RSA(Ka,MD5(U(T,M,M',R)))
3. S = RSA(Ka,MD5(U(N,T,A,M,M',R")))
4. S = RSA(Ka,MD5(U(T,M',R)))
5. S = DNS(T,MD5(U(M',R)))

where

M'= RSA(Ks,MD5(M))
R = RSA(Kr,MD5(U(M,N)))
R'= RSA(Kr,M')
R"= RSA(Kr,N)

Such incorporation of identification information relating to the sender 701, the recipient 799 or both (either by means of their digital signature, or otherwise) in the certificate generated by the service 750, can provide for more complete authentication of the entire dispatch transaction, and can be used as evidence for the dispatch and its contents by both the sender and the recipient.

BIBLIOGRAPHY AND REFERENCES

[1] "Applied Cryptography (2nd Edition)", (Schneier Bruce, John Wiley & Sons, 1996).

[1.01] see [1] Chapter 12, pp. 265-301.

[1.02] see [1] Chapter 13 Section 13.9, pp. 319-325.

[1.03] see [1] Chapter 18 Section 18.1, pp. 429-431.

[1.04] see [1] Chapter 18 Section 18.5, pp. 436-441., see also "One-Way Hash Functions," (B. Schneier, Dr. Dobb's Journal M&T Publishing Inc., September 1991 Vol 16 No.9 pp. 148-151), see also Internet Request For Comments (RFC) document 1321.

[1.05] see [1] Chapter 19 Section 19.1, pp. 461-462.

[1.06] see [1] Chapter 19 Section 19.3, pp. 466-474, see also "A Method for Obtaining Digital Signatures and Public-Key Cryptosystems" (Rivest, R.L., A. Shamir, and L. Adelman, Communications of the ACM, ACM Inc., February 1978 Vol 21 No. 2, pp. 120-126).

[1.07] see [1] Chapter 20 Section 20.1, pp. 483-494, see also "The Digital Signature Standard proposed by the National Institute of Standards and Technology" (Communications of the ACM, ACM Inc., July 1992 Vol 35 No. 7 pp. 36-40),

[1.08] see [1] Chapter 24 Section 24.12, pp. 584-587.
[1.09] see [1] Chapter 3 Section 3.2, pp. 52-56.
[1.10] see [1] Chapter 4 Section 4.1, pp. 75-79.
[1.11] see [1] Chapter 21, pp. 503-512.
[1.12] see [1] Chapter 2, Sections 2.6-2.7, pp. 34-44, see also [1] Chapter 20, pp. 483-502.
[1.13] see [1] Chapter 18, Section 18.4, pp. 455-459.

[2] U.S. Patent Documents #5,136,646, #5,136,647, and #5,373,561.

[3] "Cyclic Redundancy Checksums (Tutorial)" (Louis, B. Gregory, C Users Journal, R & D Publications Inc., Oct 1992 v10 n10 p55 (6)), see also "File verification using C.R.C." (Nelson, Mark R., Dr. Dobb's Journal, M&T Publishing Inc., May 1992 Vol 17 No. 5 p64(6)).

[4] "The MD4 Message Digest Algorithm" (R. L. Rivest, Crypto '90 Abstracts, Aug. 1990, pp. 301-311, Springer-Verlag).

[5] "A Universal Algorithm for Sequential Data Compression" (Ziv. J., Lempel A., IEEE Transactions On Information Theory, Vol 23, No. 3, pp. 337-343).

The references and publications described by the above-mentioned articles are incorporated herein by reference.

While the present invention has been described with reference to a few specific embodiments, the description is illustrative of the invention and is not to be construed as limiting the invention. It is appreciated that various combinations, modifications and implementations relating to or derived from the embodiments described herein may occur

to those skilled in the art without departing from the scope and spirit of the invention as defined by the appended claims.

WHAT IS CLAIMED IS :

1. Apparatus for authenticating that certain information has been sent by a sender via a dispatcher to a recipient, the apparatus comprising:

means for providing a set A comprising a plurality of information elements a1,...,an, said information element a1 comprising the contents of said dispatched information, and said one or more information elements a2,...,an comprising dispatch-related information and comprise at least the following elements:

a2 - a time indication associated with said dispatch; and

a3 - information describing the destination of said dispatch,

and wherein at least one of said information elements is provided in a manner that is resistant or indicative of tamper attempts by said sender;

means for associating said dispatch-related information with said element a1 by generating authentication--information, in particular comprising a representation of at least said elements a1, a2 and a3, said representation comprising a set of one or more elements, each comprising a representation of one or more elements of said set A; and

means for securing at least part of said authentication-information against undetected tamper attempts of at least said sender.

2. Apparatus according to claim 1, wherein said element a2 comprise at least one element of the group comprising the date associated with said dispatch, and the time associated with said dispatch.

3. Apparatus according to any of claims 1 or 2, wherein said dispatch-related information comprise at least one element of the group comprising the following elements: a completion indication associated with said dispatch, the number of pages dispatched, page number, an indication of identification associated with said sender, said dispatch duration, integrity information, an indication of dispatch identification associated with said dispatch, an indication of identification associated with said apparatus, a heading message, and a trailing message.

4. Apparatus according to any of claims 1 to 3, wherein said dispatched information has a form selected from the group comprising the following forms: a paper document and electronic information.

5. Apparatus according to any of claims 1 to 4, wherein the elements of said authentication-information and of said set A have a form selected from the group comprising the following forms: a paper document and electronic information, and where each of said elements can have different form.

6. Apparatus according to any of claims 1 to 5, wherein the information originally provided by said sender for dispatch has a form selected from a group comprising the following forms: a paper document and electronic information.

7. Apparatus according to any of claims 1 to 6, wherein said element a1 is provided by means comprising at least one of the following means: a communication network, a scanning device, a copier, a dispatcher, and a computer.

8. Apparatus according to any of claims 1 to 7, wherein said dispatcher comprise at least one element of the following group: a facsimile machine, a modem, a net-

work interface card (NIC), a computer, a communication line, a communication network, an E-Mail system, an EDI system, and a dispatching service.

9. Apparatus according to claim 8, wherein said dispatching service comprise at least one element of the following group: a courier service, the registered mail service of the post office, and a message transmission forwarding service.

10. Apparatus according to any of claims 1 to 9, comprising means for providing said dispatched information to said dispatcher.

11. Apparatus according to any of claims 1 to 10, and comprising at least part of said dispatcher.

12. Apparatus according to any of claims claim 1 to 11, comprising means for preparing at least one element of the group comprising the elements of said set A, and said dispatched information.

13. Apparatus according to any of claims 1 to 12, wherein said element a3 comprise at least one element of the group comprising an address associated with said dispatch, an address associated with said recipient, and an indication of identification associated with said recipient.

14. Apparatus according any of claims 1 to 13, wherein at least part of said apparatus is resistant or indicative of tamper attempts by at least said sender.

15. Apparatus according to any of claims 1 to 14, comprising means for providing at least part of said authentication-information to an interested party.

16. Apparatus according to claim 15, wherein said interested party comprise at least one element of the following group: said sender, said recipient, an arbitrator, and a legal authority.

17. Apparatus according to any of claims 1 to 16, comprising means for storing at least part of said authentication-information.

18. Apparatus according to any of claims 1 to 17, comprising means for generating a new set B, said set B comprising one or more information elements b1,...,bm, each element bi comprising a representation of a subset Si, said representation being expressive as a function Fi of the elements of said subset Si, where said subset Si comprise a digital representation of at least one element of said set A, and where said functions Fi can be different.

19. Apparatus according to claim 18, wherein at least one element of said authentication-information comprise a representation of at least part of said new set B.

20. Apparatus according to any of claims 1 to 19, wherein said set A comprise a link information element, and wherein said authentication-information comprise at least one element which comprise a representation of at least said link element.

21. Apparatus according to any of claims 18 to 20, wherein said function Fi has the property that it is substantially difficult to find a set S' comprising at least one information element, said set S' being different from said subset Si and yet can be used instead, such that applying said function Fi to said set S' will yield said element bi, i.e., such that Fi(S')=bi.

22. Apparatus according to any of claims 18 to 21, wherein said function Fi comprise one or more functions.

23. Apparatus according to any of claims 18 to 22, wherein at least one member of the group comprising the following members: said function Fi, and at least one information element of said new set B, is unknown at least to said sender.

24. Apparatus according to any of claims 1 to 23, comprising means for verifying the authenticity of an information element purported to match a corresponding element of said set A, said verification means comprising:

means for comparing a representation of said purported information element with a representation of at least part of said authentication-information which comprise a representation of at least said corresponding element of said set A to determine if they match.

25. Apparatus according to any of claims 18 to 24, comprising means for verifying the authenticity of a set Si' comprising one or more information elements which are purported to match the corresponding elements of said subset Si, said verification means comprising:

means for generating a new information element bi' comprising a representation of said set Si' which is expressive as said function Fi of the elements of said set Si'; and

means for comparing a representation of said element bi' with a representation of said element bi to determine if they match.

26. Apparatus according to any of claims 18 to 25, wherein said function Fi comprise at least one reversible function, comprising means for generating a set C which comprise one or more information elements c1,...,ck, where said set C is expressive as a function I of at least part

of said information element bi, and said function I comprising the inverse function of at least one of said reversible functions.

27. A method for authenticating that certain information has been sent by a sender via a dispatcher to a recipient, comprising the steps of:

providing a set A comprising a plurality of information elements a1,...,an, said information element a1 comprising the contents of said dispatched information, and said one or more information elements a2,...,an comprising dispatch-related information and comprise at least the following elements:

a2 - a time indication associated with said dispatch; and

a3 - information describing the destination of said dispatch,

and wherein at least one of said information elements is provided in a manner that is resistant or indicative of tamper attempts by said sender;

associating said dispatch-related information with said element a1 by generating authentication-information, in particular comprising a representation of at least said elements a1, a2 and a3, said representation comprising a set of one or more elements, each comprising a representation of one or more elements of said set A; and

securing at least part of said authentication-information against undetected tamper attempts of at least said sender.

28. A method according to claim 27, wherein at least part of the activities described by said steps is performed by an authenticator, said authenticator comprising at least one element of the following group: a party other than said sender, said dispatcher, a device, and any combination thereof.

29. A method according to any of claims 27 or 28, wherein said dispatch-related information comprise at least one element of the group comprising the following elements: a completion indication associated with said dispatch, the number of pages dispatched, page number, an indication of identification associated with said sender, said dispatch duration, integrity information, an indication of dispatch identification associated with said dispatch, an indication of identification associated with said authenticator, a heading message, and a trailing message.

30. A method according to any of claims 27 to 29, wherein said dispatched information has a form selected from the group comprising the following forms: a paper document and electronic information.

31. A method according to any of claims 27 to 30, wherein the elements of said authentication-information and of said set A have a form selected from the group comprising the following forms: a paper document and electronic information, and where each of said elements can have different form.

32. A method according to any of claims 27 to 31, wherein the information originally provided by said sender for dispatch has a form selected from a group comprising the following forms: a paper document and electronic information.

33. A method according to any of claims 27 to 32, wherein said element a1 is provided by means comprising at least one of the following means: a communication network, a scanning device, a copier, a dispatcher, and a computer.

34. A method according to any of claims 27 to 33, wherein said dispatcher comprise at least one element of the following group: a facsimile machine, a modem, a net-

work interface card (NIC), a computer, a communication line, a communication network, an E-Mail system, an EDI system, and a dispatching service.

35. A method according to claim 34, wherein said dispatching service comprise at least one element of the following group: a courier service, the registered mail service of the post office, and a message transmission forwarding service.

36. A method according to any of claims 27 to 35, comprising the step of providing said dispatched information to said dispatcher.

37. A method according to any of claims 27 to 36, wherein said element a2 comprise at least one element of the group comprising the date associated with said dispatch, and the time associated with said dispatch.

38. A method according to any of claims 27 to 37, comprising the step of preparing at least one element of the group comprising the elements of said set A, and said dispatched information.

39. A method according to any of claims 27 to 38, wherein said element a3 comprise at least one element of the group comprising an address associated with said dispatch, an address associated with said recipient, and an indication of identification associated with said recipient.

40. A method according any of claims 27 to 39, comprising the step of dispatching said information to said recipient.

41. A method according to any of claims 27 to 40, comprising the step of providing a representation of at

least part of said authentication-information to an interested party.

42. A method according to claim 41, wherein said interested party comprise at least one element of the following group: said sender, said recipient, an arbitrator, and a legal authority.

43. A method according to any of claims 27 to 42, comprising the step of storing at least part of said authentication-information in a storage device.

44. A method according to any of claims 28 or 43, wherein at least part of said device is resistant or indicative of tamper attempts by at least said sender.

45. A method according to any of claims 27 to 44, comprising the step of generating a new set B, said set B comprising one or more information elements b1,...,bm, each element bi comprising a representation of a subset Si, said representation being expressive as a function Fi of the elements of said subset Si, where said subset Si comprise a digital representation of at least one element of said set A, and where said functions Fi can be different.

46. A method according to claim 45, wherein at least one element of said authentication-information comprise a representation of at least part of said new set B.

47. A method according to any of claims 27 to 46, wherein said set A comprise a link information element, and wherein said authentication-information comprise at least one element which comprise a representation of at least said link element.

48. A method according to any of claims 45 to 47, wherein said function Fi has the property that it is sub-

stantially difficult to find a set S' comprising at least one information element, said set S' being different from said subset Si and yet can be used instead, such that applying said function Fi to said set S' will yield said element bi, i.e., such that Fi(S')=bi.

49. A method according to any of claims 45 to 48, wherein said function Fi comprise one or more functions.

50. A method according to any of claims 45 to 49, wherein at least one member of the group comprising the following members: said function Fi, and at least one information element of said new set B, is unknown at least to said sender.

51. A method according to any of claims 27 to 50, comprising the step of verifying the authenticity of an information element purported to match a corresponding element of said set A, said verification step comprising the step of:

comparing a representation of said purported information element with a representation of at least part of said authentication-information which comprise a representation of at least said corresponding element of said set A to determine if they match.

52. A method according to any of claims 45 to 51, comprising the step of verifying the authenticity of a set Si' comprising one or more information elements which are purported to match the corresponding elements of said subset Si, said verification step comprising the steps of:

generating a new information element bi' comprising a representation of said set Si' which is expressive as said function Fi of the elements of said set Si'; and

comparing a representation of said element bi' with a representation of said element bi to determine if they match.

53. A method according to any of claims 45 to 52, wherein said function Fi comprise at least one reversible function, comprising the step of generating a set C which comprise one or more information elements c1,...,ck, where said set C is expressive as a function I of at least part of said information element bi, and said function I comprising the inverse function of at least one of said reversible functions.

54. Apparatus according to any of claims 18 to 26, wherein said new set B comprises a verifiable digital signature of said subset Si.

55. Apparatus according to claim 54, comprising a corresponding verification means for said verifiable digital signature, for authenticating at least one of the following: at least one element of said subset Si, and the originator of said digital signature.

56. Apparatus according to any of claims 54 or 55, wherein said digital signature is generated according to a scheme selected from the group comprising: secret-key (symmetric) cryptosystem, and public-key cryptosystem.

57. Apparatus according to any of claims 1 to 26, or 54 to 56, comprising means for time-stamping at least one element of the group comprising the elements of said authentication-information and the elements of said set A, according to a Time Stamping Service scheme.

58. Apparatus according to any of claims 1 to 26, or 54 to 57, comprising means for authenticating the identity of at least one member of the group comprising: said sender, said recipient, an agent of said sender, and an agent of said recipient.

59. A method according to any of claims 45 to 53, wherein said new set B comprises a verifiable digital signature of said subset Si.

60. A method according to claim 59, comprising a corresponding verification step for said verifiable digital signature, for authenticating at least one of the following: at least one element of said subset Si, and the originator of said digital signature.

61. A method according to any of claims 59 or 60, wherein said digital signature is generated according to a scheme selected from the group comprising: secret-key (symmetric) cryptosystem, and public-key cryptosystem.

62. A method according to any of claims 27 to 53, or 59 to 61, comprising the step of time-stamping at least one element of the group comprising the elements of said authentication-information and the elements of said set A, according to a Time Stamping Service scheme.

63. A method according to any of claims 27 to 53, or 59 to 62, comprising the step of authenticating the identity of at least one member of the group comprising: said sender, said recipient, an agent of said sender, and an agent of said recipient.

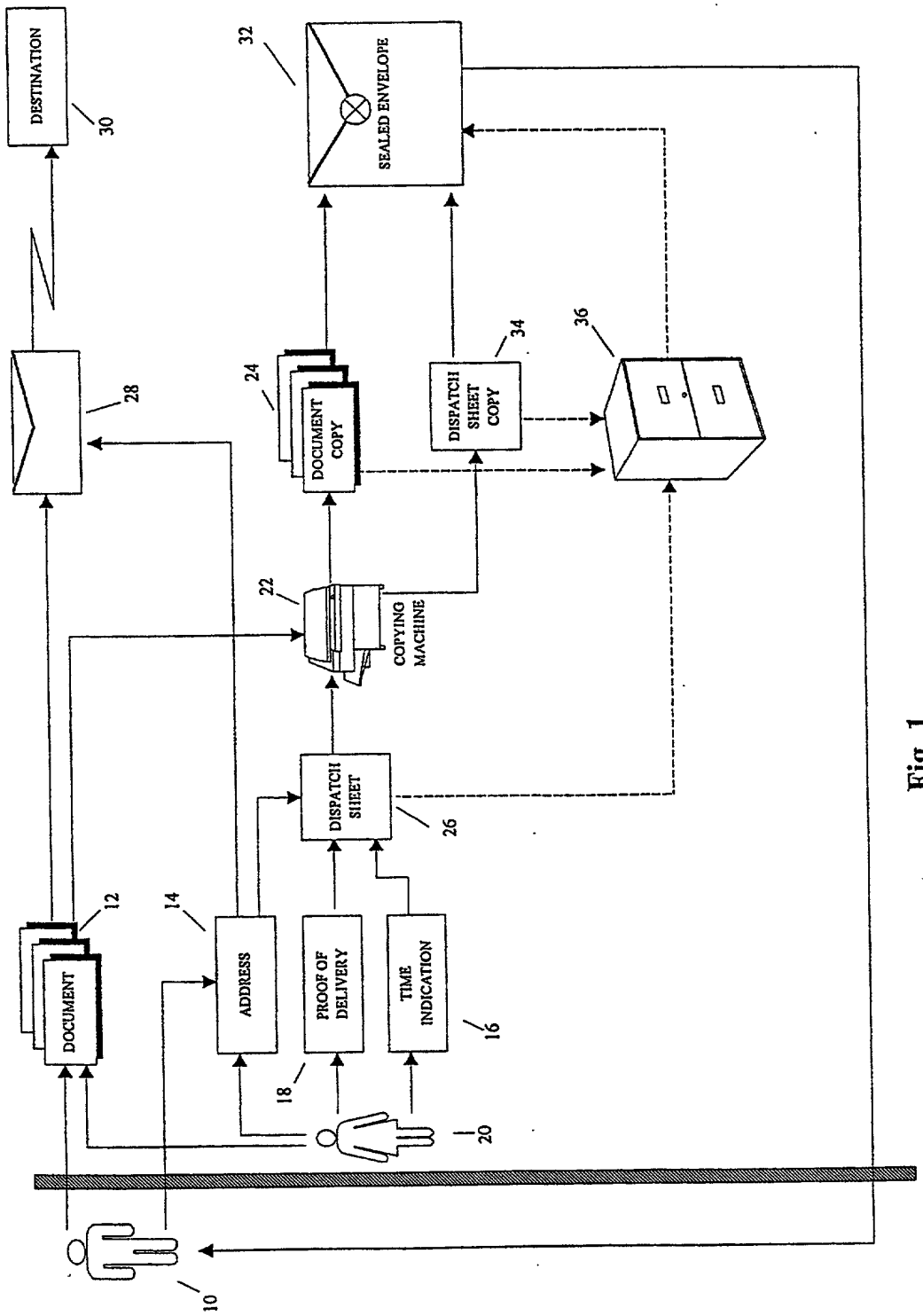
DESTINATION
30
32
SEALED ENVELOPE
28
24
DOCUMENT COPY
DISPATCH SHEET COPY
34
36
22
COPYING MACHINE
DISPATCH SHEET
26
12
DOCUMENT
14
ADDRESS
PROOF OF DELIVERY
TIME INDICATION
16
18
20
10

Fig. 1

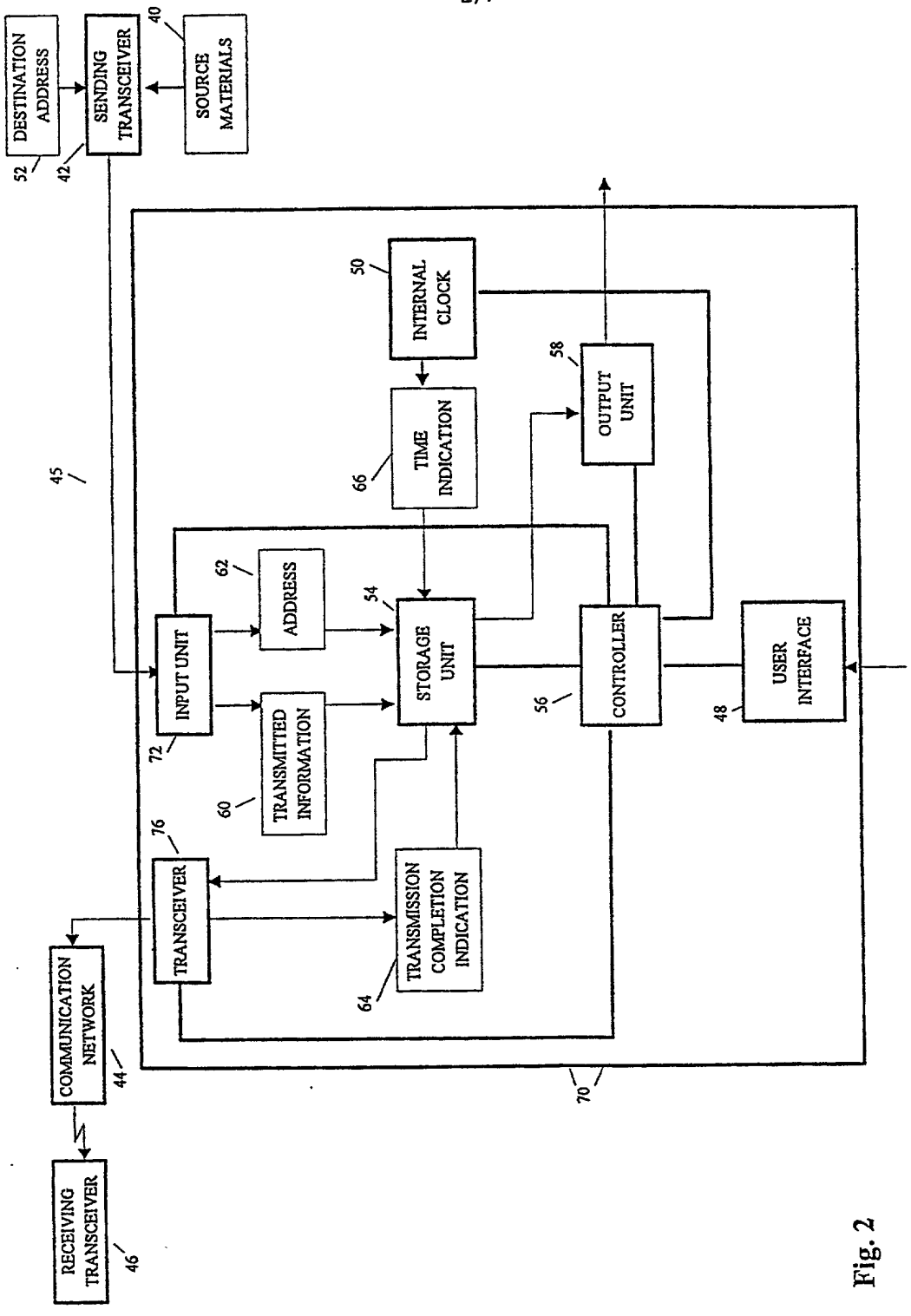
DESTINATION ADDRESS
52
SENDING TRANSCEIVER
42
40
SOURCE MATERIALS
45
INTERNAL CLOCK
50
TIME INDICATION
66
OUTPUT UNIT
58
ADDRESS
62
INPUT UNIT
72
STORAGE UNIT
54
CONTROLLER
56
USER INTERFACE
48
TRANSMITTED INFORMATION
60
TRANSCEIVER
76
TRANSMISSION COMPLETION INDICATION
64
COMMUNICATION NETWORK
44
RECEIVING TRANSCEIVER
46
70

Fig. 2

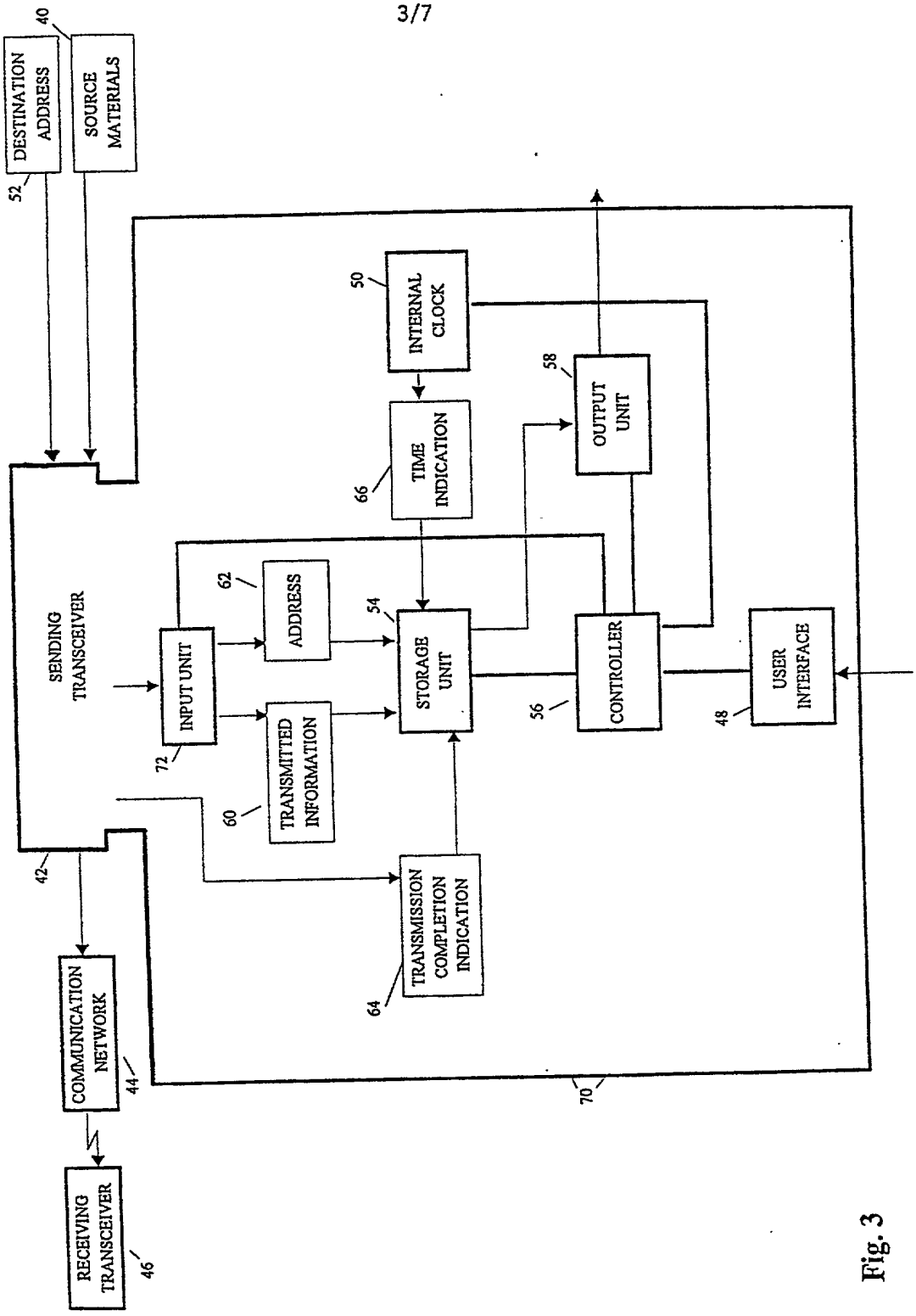
DESTINATION ADDRESS
SOURCE MATERIALS
40
52
INTERNAL CLOCK
50
OUTPUT UNIT
58
TIME INDICATION
66
SENDING TRANSCEIVER
ADDRESS
62
INPUT UNIT
72
STORAGE UNIT
54
CONTROLLER
56
USER INTERFACE
48
TRANSMITTED INFORMATION
60
TRANSMISSION COMPLETION INDICATION
64
42
COMMUNICATION NETWORK
44
RECEIVING TRANSCEIVER
46
70

Fig. 3

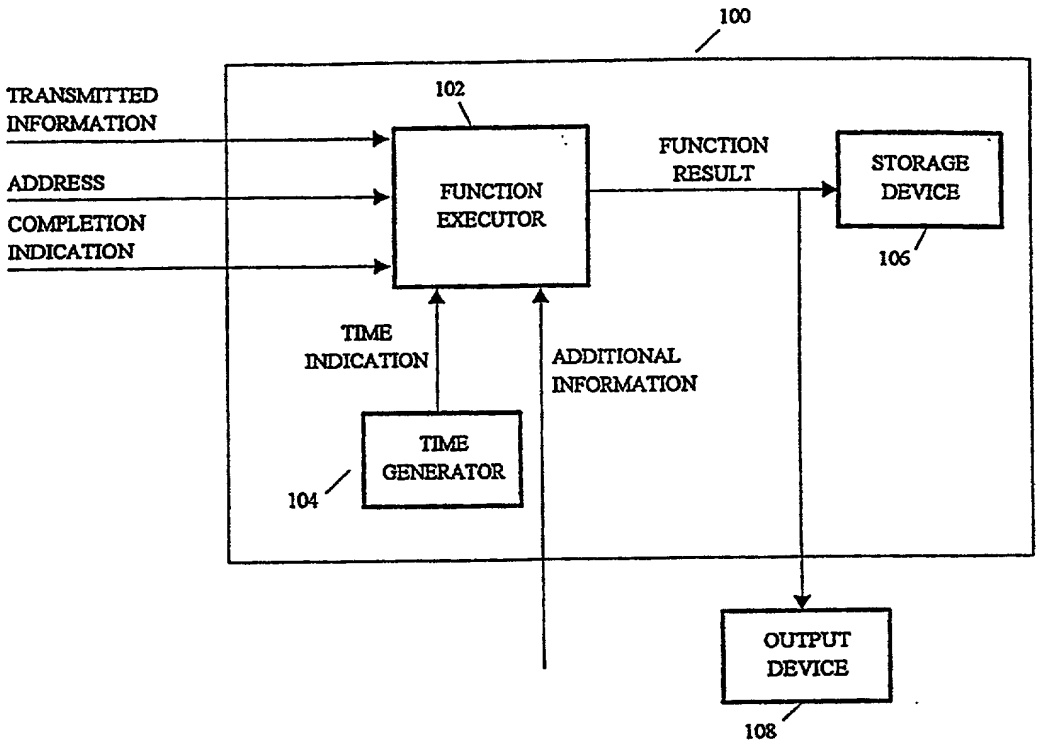
100
102
TRANSMITTED INFORMATION
ADDRESS
COMPLETION INDICATION
FUNCTION EXECUTOR
FUNCTION RESULT
STORAGE DEVICE
106
TIME INDICATION
ADDITIONAL INFORMATION
TIME GENERATOR
104
OUTPUT DEVICE
108

FIG. 4

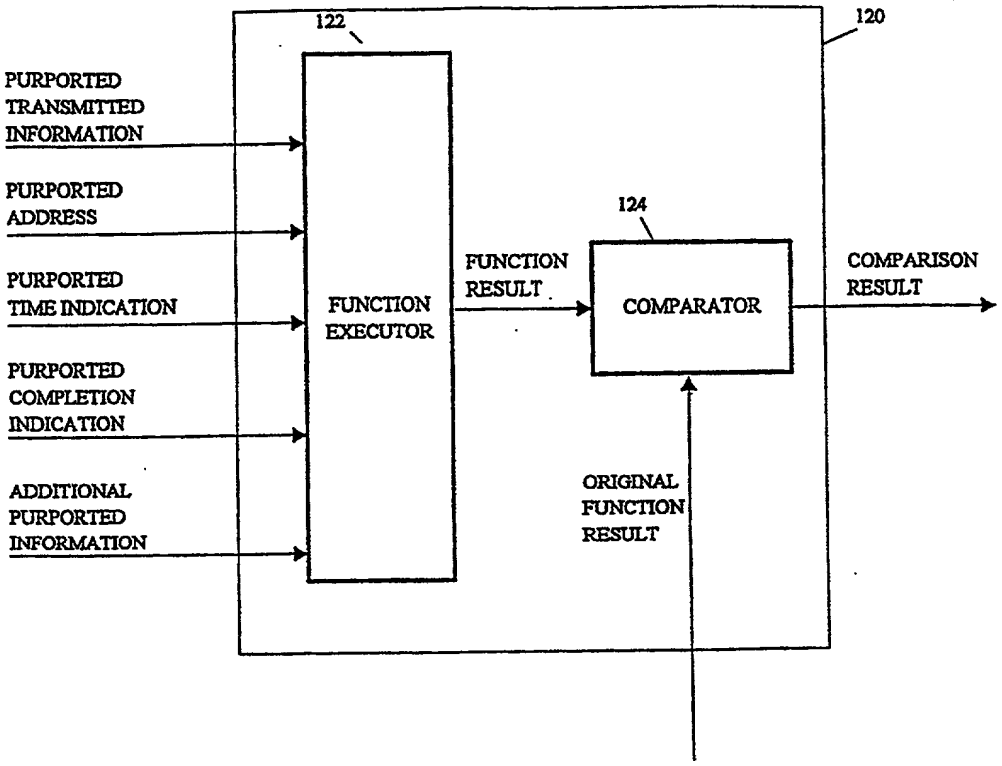
122
120
PURPORTED TRANSMITTED INFORMATION
PURPORTED ADDRESS
PURPORTED TIME INDICATION
PURPORTED COMPLETION INDICATION
ADDITIONAL PURPORTED INFORMATION
FUNCTION EXECUTOR
FUNCTION RESULT
124
COMPARATOR
COMPARISON RESULT
ORIGINAL FUNCTION RESULT

FIG. 5

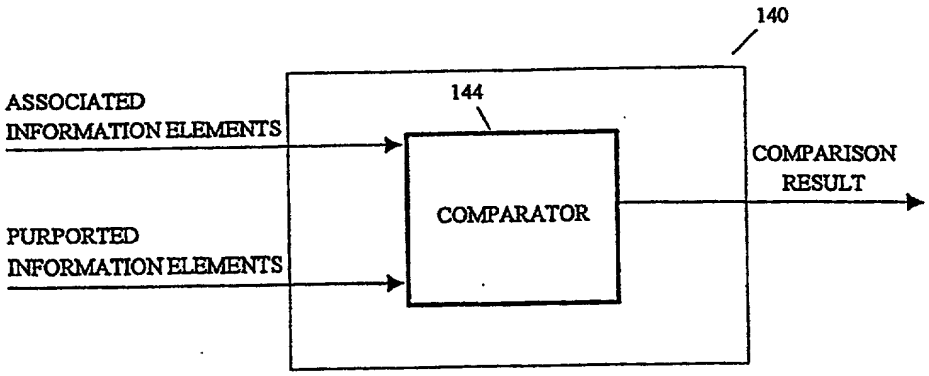
140
144
ASSOCIATED
INFORMATION ELEMENTS
PURPORTED
INFORMATION ELEMENTS
COMPARATOR
COMPARISON
RESULT

FIG. 6

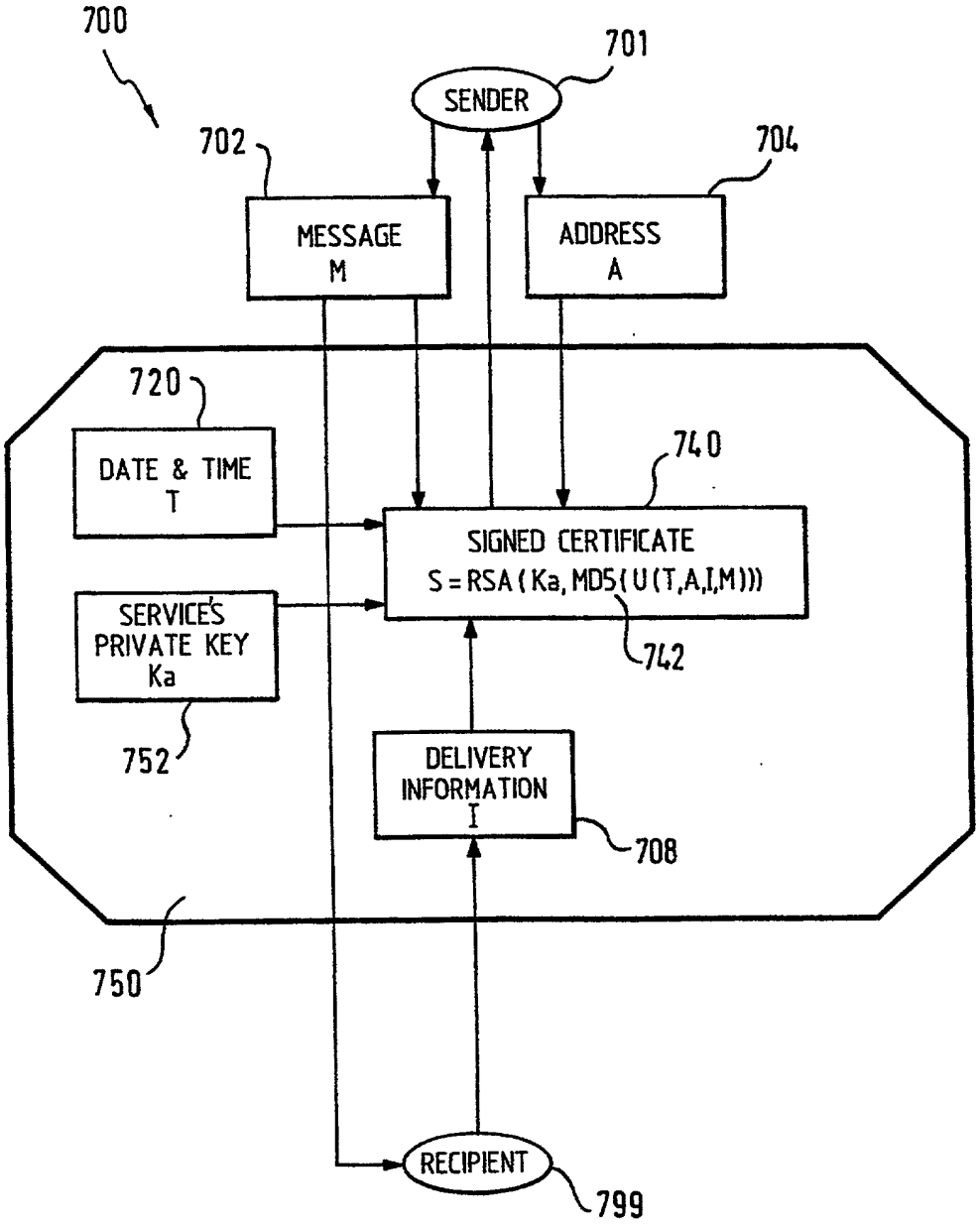

Fig. 7

E-MAIL AUTHENTICATION SERVICE
USING DIGITAL SIGNATURES

INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/IB 96/00859

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04L9/32

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP,A,0 516 898 (PITNEY BOWES INC.) 9 December 1992 cited in the application see abstract see column 2, line 34 - column 3, line 11 see column 4, line 24 - column 5, line 57 see figure 1	1,27
A	D.W.DAVIES & W.L.PRICE: "SECURITY FOR COMPUTER NETWORKS" 1989 , JOHN WILEY & SONS , CHICHESTER (UK) XP002020015 cited in the application see page 130, line 25 - page 131, line 28	1,27

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
2 December 1996	17. 12. 96

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Lydon, M

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

.ormation on patent family members

Intern ıal Application No
PCT/IB 96/00859

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A-516898	09-12-92	US-A- 5022080	04-06-91

PATENT
Attorney's Docket No. 75483

COMBINED DECLARATION AND POWER OF ATTORNEY

As below named inventor, I hereby declare that

This declaration is of the following type:
☐ original ☐ design ☐ supplemental
☒ national stage of PCT
☐ divisional ☐ continuation ☐ continuation-in-part

My residence, post office address, and citizenship are as stated below next to my name. I believe I am an original, first, and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled:

APPARATUS AND METHOD FOR AUTHENTICATING THE DISPATCH AND CONTENT OF DOCUMENTS

the specification of which:
☐ is attached hereto.
☐ was filed on ____ as Serial No. _____ and was amended on ____ *(if applicable).*
☐ was filed by Express Mail No. _____ *as Serial No. not known yet,* and was amended on _____ *(if applicable).*
☒ was described and claimed in PCT International Application No PCT/IB96/00859 filed on August 27, 1996, and as amended under PCT Article 19 on _____ *(if any).*

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, § 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

COUNTRY	APPLICATION	DATE OF FILING (day,month,year)	PRIORITY CLAIMED UNDER 35 USC 119			
European Patent Office	95113489.9	28 August 1995	X	YES		NO
Israel	117234	22 February 1996	X	YES		NO
				YES		NO

I hereby claim the benefit pursuant to Title 35, United States Code, § 119(e) of the following United States provisional application(s):

PRIOR U.S. PROVISIONAL APPLICATIONS CLAIMING THE BENEFIT UNDER 35 USC 119(e)	
APPLICATION NO.	DATE OF FILING

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56 which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application.

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 USC 120					
U.S. APPLICATIONS			STATUS *(check one)*		
U.S. APPLICATIONS	U.S. FILING DATE		PATENTED	PENDING	ABANDONED
1.					
2.					
3.					
PCT APPLICATIONS DESIGNATING THE U.S.			STATUS *(check one)*		
PCT APPLICATION NO.	PCT FILING DATE	U.S. SERIAL NOS. ASSIGNED (if any)	PATENTED	PENDING	ABANDONED
4. PCT/IB96/00859	27 August 1996			X	
5.					
6.					

DETAILS OF FOREIGN APPLICATIONS FROM WHICH PRIORITY CLAIMED UNDER 35 USC 119 FOR ABOVE LISTED U.S./PCT APPLICATIONS				
ABOVE APPLN. NO.	COUNTRY	APPLICATION NO.	DATE OF FILING (DAY,MONTH,YR)	DATE OF ISSUE (DAY,MONTH,YR)
1.				
2.				
3.				
4. PCT/IB96/00859	1) European Pat. Off. 2) Israel	1) 95113489.9 2) 117234	1) 28 August 1995 2) 22 February 1996	
5.				
6.				

As a named inventor, I hereby appoint the following attorneys to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

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David M. Airan, Reg. 38811
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G. Russell Thill, Reg. 39854
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David J. Schodin, Reg. 41294

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I hereby declare that all statements made herein of my own knowledge are true, that all statements made on information and belief are believed to be true, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Inventor's signature Ofra Feldbau

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